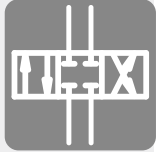


# Proportional directional spool valves types PSL, PSV size 2

## Product documentation



### Series connection

Operating pressure $p_{\max}$ :	420 bar
Flow rate (pump) $Q_{\max}$ :	100 lpm
Flow rate (consumer) $Q_{\max A/B}$ :	60 lpm



© by HAWE Hydraulik SE.

The reproduction and distribution of this document as well as the use and communication of its contents to others without explicit authorisation is prohibited.

Offenders will be held liable for the payment of damages.

All rights reserved in the event of patent or utility model applications.

Brand names, product names and trademarks are not specifically indicated. In particular with regard to registered and protected names and trademarks, usage is subject to legal provisions.

HAWE Hydraulik respects these legal provisions in all cases.

Printing date / document generated on: 29.09.2021

# Contents

<b>1</b>	<b>Introductory description of proportional directional spool valves types PSL, PSV, size 2.....</b>	<b>4</b>
1.1	Configuration example PSL 2.....	5
1.2	Configuration example PSL 2 together with PSL 5, PSL 3 and EDL 2.....	6
<b>2</b>	<b>Available versions, main data.....</b>	<b>7</b>
2.1	Order coding, overview.....	7
2.2	Connection block.....	8
2.3	Valve section.....	16
2.3.1	Directional valve section.....	18
2.3.2	Ancillary block.....	36
2.3.3	Intermediate plate (on the consumer side).....	40
2.4	Series intermediate plate.....	45
2.5	End plate.....	50
2.6	Solenoid versions.....	53
<b>3</b>	<b>Parameters.....</b>	<b>56</b>
3.1	General and hydraulic.....	56
3.2	Characteristic lines.....	59
3.3	Electrical parameters.....	62
3.3.1	Electro-hydraulic actuation with standard solenoid.....	62
3.3.2	Electro-hydraulic actuation with solenoid for potentially explosive atmospheres.....	64
3.3.3	Switching position monitoring, displacement transducer.....	65
3.3.4	Electric LS relief or LS pressure limitation.....	68
3.3.5	Electric LS relief or LS pressure limitation for potentially explosive atmospheres.....	69
3.3.6	Additional valves.....	69
<b>4</b>	<b>Dimensions.....</b>	<b>70</b>
4.1	Connection block.....	70
4.2	Valve section.....	78
4.2.1	Directional valve section.....	78
4.2.2	Ancillary block.....	90
4.2.3	Intermediate plate.....	102
4.3	Series intermediate plate.....	107
4.4	End plate.....	110
<b>5</b>	<b>Assembly, operation and maintenance recommendations.....</b>	<b>113</b>
5.1	Intended use.....	113
5.2	Assembly information.....	113
5.2.1	Attachment.....	113
5.2.2	Piping.....	113
5.2.3	Converting the connection block from PSL to PSV.....	114
5.2.4	Notes on spool valve exchange.....	115
5.2.5	Seal kits.....	115
5.3	Operating instructions.....	116
5.4	Maintenance information.....	116

# 1 Introductory description of proportional directional spool valves types PSL, PSV, size 2

Proportional directional spool valves are a type of directional valve. They control the direction of movement and the velocity of individual or multiple hydraulic consumers actuated simultaneously. Control is independent of the load and continuous.

## Features and benefits:

- Universally usable product for various flow rates and functions
- Extensive modular system with many variants and combination options
- Compact and lightweight design
- Robust and long-lived design for pressures up to 420 bar
- Highest energy efficiency thanks to low  $\Delta p$  and low-energy solutions

## Intended applications:

- Loading cranes
- Lifting platforms
- Municipal trucks
- Construction machines
- Drilling equipment
- Machines for forestry and agricultural purposes

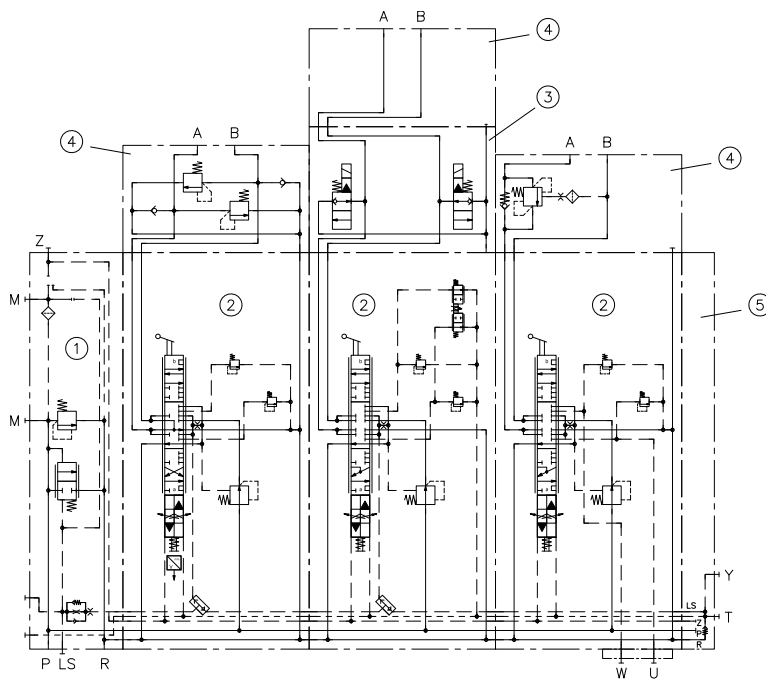


Proportional directional spool valve type PSL 2

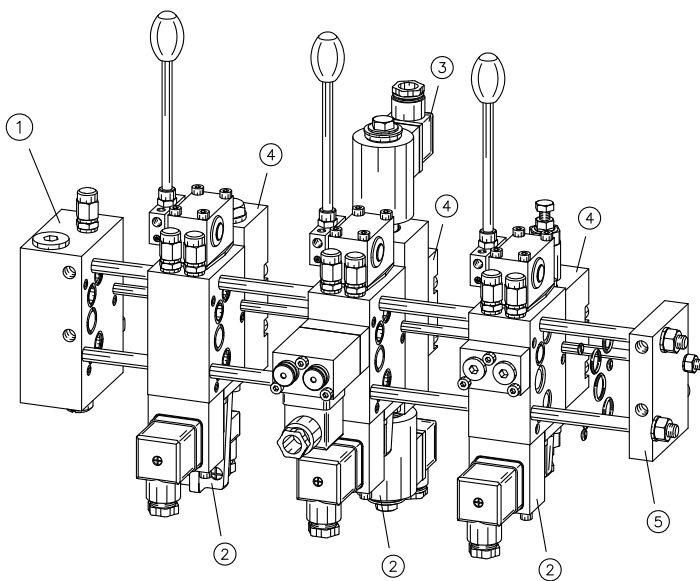
## 1.1 Configuration example PSL 2

PSL 31/420-2

- A2 H 25/40 A250 B300 /EA/WA/2 AN275 BN 320
- A2 L 10/16 A150 B150 FP3 /EA/ZVV/2
- A2 L 6/6 A200 B120 S1 /EA/2 AL 180
- E4 - G 24

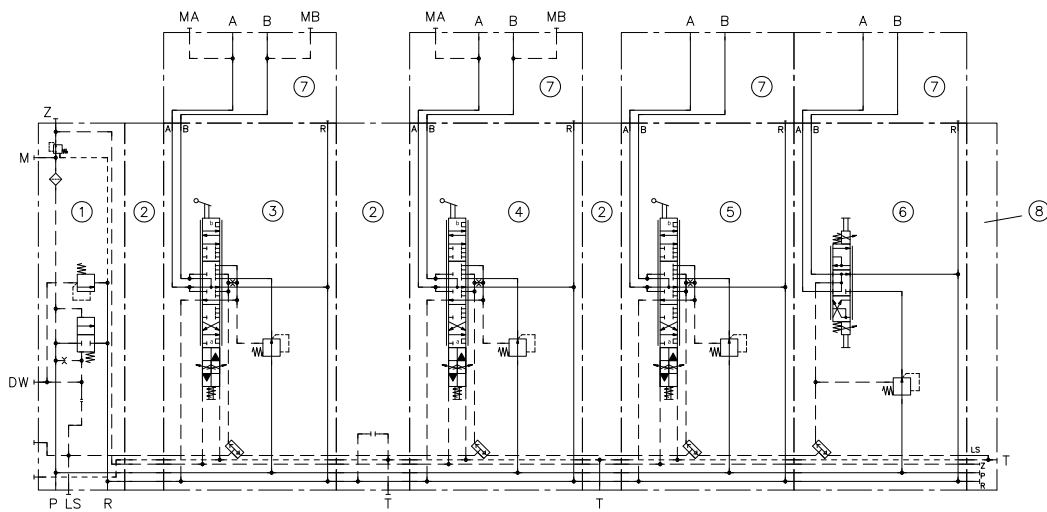


- 1 Connection block
- 2 Valve section or series intermediate plate
- 3 Intermediate plate
- 4 Ancillary block
- 5 End plate

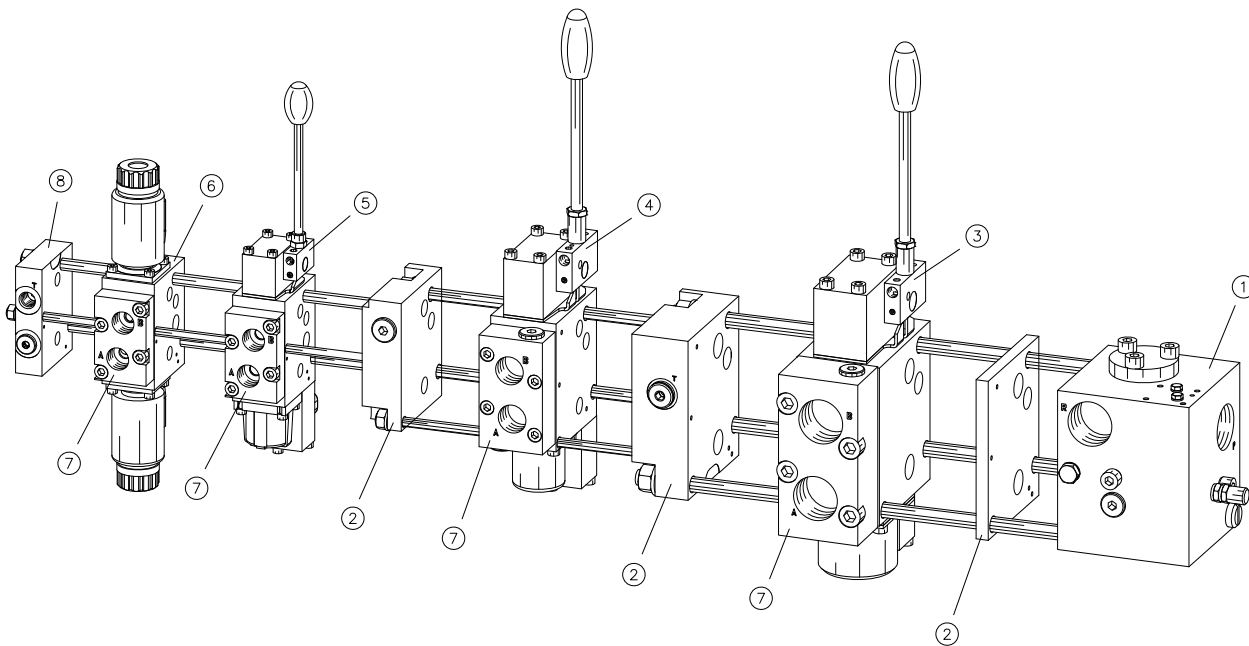


## 1.2 Configuration example PSL 2 together with PSL 5, PSL 3 and EDL 2

PSV 51/300-5  
 - ZPL 55/9  
 - A2 H 160/160/EA/5  
 - ZPL 531  
 - A2 H 80/80/EA/3  
 - ZPL 32  
 - A2 H 40/40/EA/2  
 - DA2 H 40/40/EI/2  
 - E 1-DT 24



- 1 PSL 5 connection block
- 2 Intermediate plate
- 3 PSL 5 valve section
- 4 PSL 3 valve section
- 5 PSL 2 valve section
- 6 EDL 2 valve section
- 7 Ancillary block
- 8 PSL 2 end plate



## 2 Available versions, main data

### 2.1 Order coding, overview

Ordering example:

PSL 31/420-2	- A2 H 25/40 A250 B300 /EA/WA/2 AN 275 BN 320 - A2 L 10/16 A150 B150 FP3 /EA/ZVV/2 - A2 L 6/6 A200 B120 S1 /EA/2 AL 180	- ZPL 22/15/R1	- E4 G 24
--------------	---	----------------	-----------

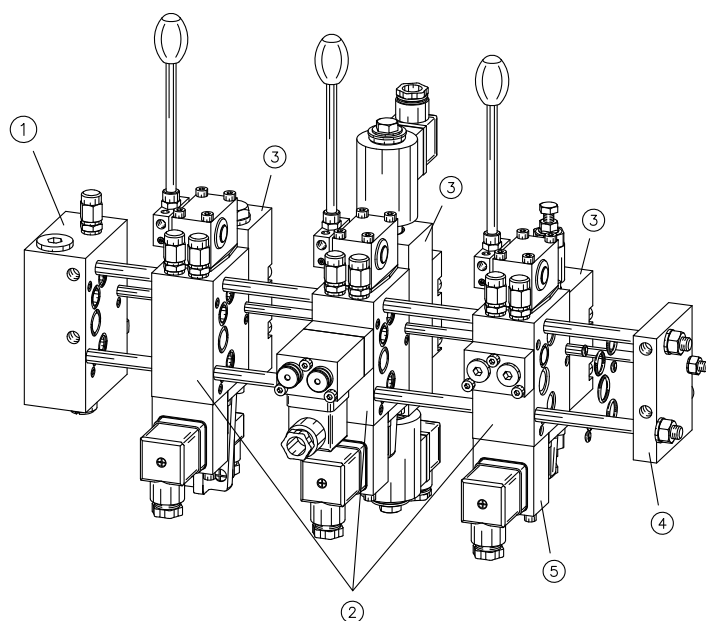
End plate and solenoid version

- [2.5 "End plate", Page 50](#)
- [2.6 "Solenoid versions", Page 53](#)

Series intermediate plate [2.4 "Series intermediate plate", Page 45](#)

Valve sections [2.3 "Valve section", Page 16](#)

Connection block [2.2 "Connection block", Page 8](#)



- 1 Connection block
- 2 Valve section or series intermediate plate
- 3 Ancillary block
- 4 End plate
- 5 Solenoid voltage and solenoid version

A manifold can merge up to 14 size 2 valve sections.

This number can be increased by combining with a PSL 5 or PSL 3. In this case, transition plates are used and each size has its own tension rod.

**Limits to the maximum possible number of valve sections result from:**

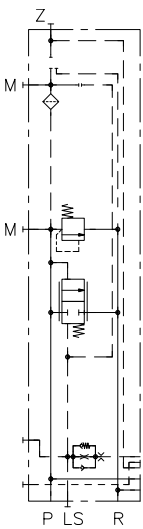
- a) tension rod strength
- b) internal control oil supply for the electro-hydraulic actuation
- c) the available control pressure difference for supply to the rear valve sections

## 2.2 Connection block

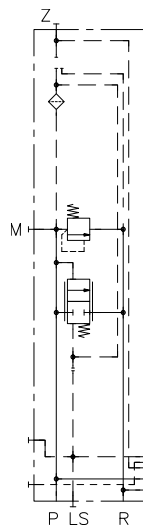
Connection blocks come in two basic variants:

- **PSL:** Connection block with integrated 3-way controller for use in open centre systems with constant pumps
- **PSV:** Connection block without 3-way controller for use in closed centre systems with variable pumps or for simultaneous supply of two or more manifolds from a shared constant pump

**PSL**



**PSV**



Depending on the configuration, the connection blocks contain:



- A 3-way controller for open centre systems with constant pump
- A pressure-limiting valve to ensure maximum system pressure
- An LS pressure-limiting valve to cap or relieve LS pressure
- A damping element to attenuate LS signal oscillation
- A pressure reducing valve for internal control oil supply to the downstream valve sections
- Various additional elements (e.g. idle circulation valve, power-beyond function, P-gallery shut-off, mechanical locking of the 3-way controller)



### Ordering example:

PSL 3	H	G	1	F	/420	- 2
						Size <a href="#">"Table 9"</a>
						System pressure limitation <a href="#">"Table 8"</a>
						LS relief or LS pressure limitation <a href="#">"Table 7"</a>
						Internal control oil supply <a href="#">"Table 6"</a>
						LS damping <a href="#">"Table 5"</a>
						Additional elements for 3-way controller <a href="#">"Table 4"</a>

- Basic type**
- ["Table 1: Basic version"](#)
  - ["Table 2: Connections for P and R"](#)
  - ["Table 3: Connection block basic types"](#)

**Table 1 Basic version**

Type	Description
PSL	Connection block with integrated 3-way controller for use in open centre systems with constant pumps
PSV	Connection block without 3-way controller for use in closed centre systems with variable pumps or for simultaneous supply of two or more manifolds from a shared constant pump

**i NOTE**

For instructions on how to convert the connection block from PSL to PSV, refer to [Chapter 5.2.3](#)

**Table 2 Connections**

Coding	Description of P and R port
3	G 1/2 (ISO 228-1)
4	G 3/4 (ISO 228-1)
5	G 1 (ISO 228-1)
UNF 2	3/4-16UNF 2B or SAE-8 (SAE J 514)
UNF 4	1 1/16-12 UN-2B or SAE-12 (SAE J 514)

**Table 3 Connection block basic types**

**PSL connection blocks**

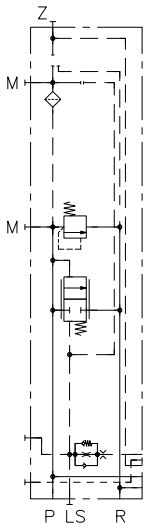
Coding	Description
<p>PSL 3.../D...-2 PSL UNF 2.../D...-2</p>	<p>Standard connection block with integrated 3-way controller.</p> <p>Pressure-limiting valve: direct actuation</p>
<p>PSL 3U.../...-2 PSL UNF 2U.../...-2</p>	<p>Additional idle circulation valve for automatic reduction of circulation pressure.</p> <p>The idle circulation valve opens when the current LS pressure drops below 25% of pump pressure. Electro-hydraulic actuation with internal control oil supply requires a pump flow rate of at least 80 lpm, pilot pressure will otherwise not suffice to shift the spool valve. Load pressure must be at least 20 bar.</p> <p>Pressure-limiting valve: pilot-controlled</p>
<p>PSL 3 Z.../D...-2</p>	<p>Additional release valve for quick release of pressure in neutral position.</p> <p>Once all valve sections signal an LS pressure below around 1/3 of the 3-way controller's spring cavity pressure, the release valve opens to the reflux. The LS pressure in the 3-way controller's spring cavity is released to R. Common applications include oscillation-sensitive systems and combinations with load-holding valves.</p> <p>Pressure-limiting valve: direct actuation</p> <div data-bbox="352 891 1501 981" style="border: 1px solid gray; padding: 5px;"> <p><b>!</b> <b>NOTE</b> A SL2-ZPL 22/7 spacer plate is required afterwards</p> </div>
<p>PSL 3 Y.../...-2</p>	<p>Special version with an additional connection suitable for pressure loads for the 3-way controller's outflow (power beyond function).</p> <p>You can connect a second manifold to the F port. The first manifold's valve sections are prioritised. The downstream manifold receives the excess volume.</p> <p>Pressure-limiting valve: direct actuation</p>

## PSV connection blocks

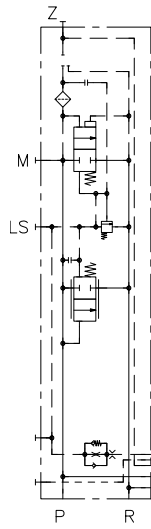
Coding	Description
<b>PSV 3...-2</b> <b>PSV UNF 2...-2</b>	Standard connection block without 3-way controller.  Pressure-limiting valve: without
<b>PSV 3.../D...-2</b> <b>PSV UNF 2.../D...-2</b>	Standard connection block without 3-way controller.  Pressure-limiting valve: direct actuation
<b>PSV 4N.../.../...-2</b> <b>PSV UNF 4N.../.../...-2</b>	<p>P-line cut off to safely shut off pump and consumer from one another and prevent undesired movements.</p> <p>The P channel incorporates a piston controlled by a 2/2-way directional valve. When unpowered, the piston securely seals the P channel; actuating the 2/2-way directional valve opens the P channel.</p> <ul style="list-style-type: none"> <li>▪ <b>PSV 4 N...:</b> 2/2-way directional valve type EM 11 S as per <a href="#">D 7490/1</a></li> <li>▪ <b>PSV 4 N M...:</b> with wing bolt for mechanical locking (EM 11 S-...-M)</li> <li>▪ <b>PSV 4 N P...:</b> with button for manual override (EM 11 ST)</li> </ul> <p>Only possible in conjunction with LS damping <a href="#">"Table 5"</a></p> <p>Optionally an additional LS release valve is available to depressurise the LS signal and switch the variable pump to standby pressure.</p> <ul style="list-style-type: none"> <li>▪ <b>PSV (UNF) 4 N...V/...:</b> LS relief, closed when unpowered (EM 11 V as per <a href="#">D 7490/1</a>)</li> <li>▪ <b>PSV (UNF) 4 N...Z/...:</b> LS relief, open when unpowered (EM 11 S as per <a href="#">D 7490/1</a>)</li> <li>▪ <b>PSV (UNF) 4 N...ZM/...:</b> LS relief, open when unpowered, with wing bolt for mechanical locking (EM 11 S-...-M)</li> <li>▪ <b>PSV (UNF) 4 N...ZP/...:</b> LS relief, open when unpowered, with button for manual override (EM 11 ST)</li> </ul> <p><b>Ordering example:</b> PSV 4 N B 61ZM/220/200-2</p> <ul style="list-style-type: none"> <li>– Setting for main pressure-limiting valve: 220 bar</li> <li>– Setting for LS pressure-limiting valve: 200 bar</li> </ul>
	<p><b>! NOTE</b></p> <p>When using a P-line cut off, there is an additional pressure drop in the P channel that can lead to the downstream sections no longer reaching nominal flow.</p> <p><b>Nominal flow undercut depends on</b></p> <ol style="list-style-type: none"> <li>a) control pressure difference in the variable pump's pump controller,</li> <li>b) the position of the valve sections in the manifold and</li> <li>c) flow rate through the P-line cut off.</li> </ol> <p>Nominal flow undercut can reach up to 30% of <math>Q_{\text{nominal}}</math>, see <a href="#">"Table 15: Flow rate"</a>.</p>
<b>PSV 3X...-2</b>	<p><b>Special version without</b></p> <ul style="list-style-type: none"> <li>▪ Without 3-way controller</li> <li>▪ Without pressure-limiting valve</li> <li>▪ Without pressure reducing valve for internal control oil supply (only possible for E0A, E0H, E0Z, E0AR, E0K)</li> <li>▪ Without interface for LS pressure-limiting valve – or release valve</li> </ul> <p>Only for valve sections with A, P or H actuation</p> <p>Damping in LS: Standard - none            B4, B5, ...: With orifice <math>\varnothing</math> 0.4, 0.5, ... e.g. PSV 3X B5-2</p> <p><b>! NOTE</b></p> <p>No retrofitting on electro-hydraulic actuation E.. possible</p>

Circuit symbols

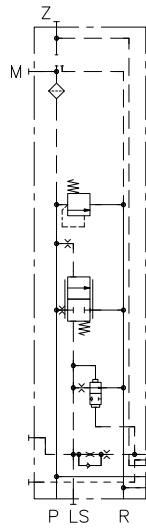
PSL 3.../D...-2  
PSL UNF 2.../D...-2



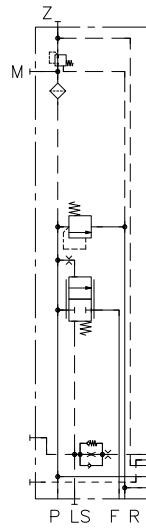
PSL 3U.../...-2  
PSL UNF 2U.../...-2



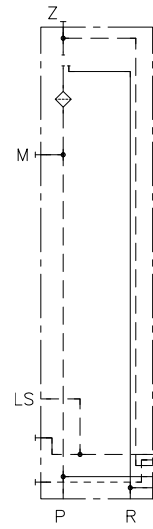
PSL 3 Z.../D...-2



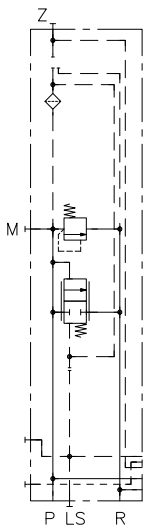
PSL 3Y.../...-2



PSV 3...-2  
PSV UNF 2...-2



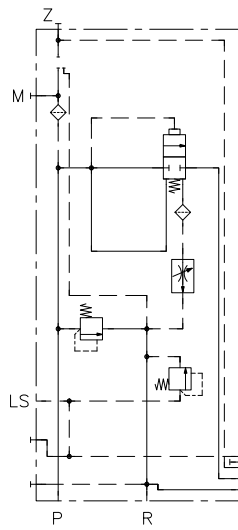
PSV 3.../D...-2  
PSV UNF 2.../D...-2



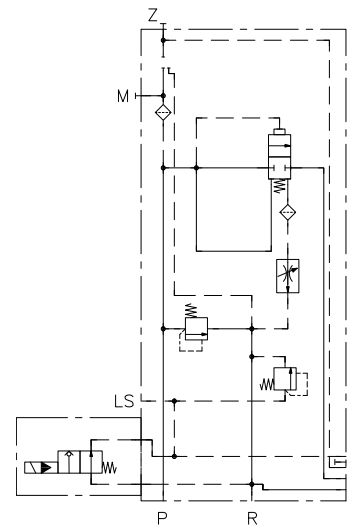
PSV 3X...-2



PSV 4 N.../.../...-2  
PSV UNF 4 N.../.../...-2





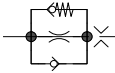
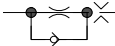
PSV 4 N...Z.../.../...-2  
PSV UNF 4 N...Z.../.../...-2



**Table 4 Additional elements for 3-way controller and add-on**

Coding	Description
Without coding	Standard version 3-way controller with 9 bar circulation pressure
T	Special version for mechanical locking of the 3-way controller with 9 bar circulation pressure. Can be adjusted using tools.
H	Special version 3-way controller with higher circulation pressure of 14 bar
HT	Special version for mechanical locking of the 3-way controller with 14 bar circulation pressure. Can be adjusted using tools.

**Table 5 LS damping**

Coding	Description	Circuit symbol
Without coding	<ul style="list-style-type: none"> <li>▪ For PSL and PSM: as for coding S</li> <li>▪ For PSV: without LS damping</li> </ul>	--
B	∅ 0.8 mm orifice	
B 4	∅ 0.4 / 0.5 / 0.6 / 0.7 mm orifice	
B 5		
B 6		
B 7		
B 55	Two ∅ 0.5 mm orifices in series	
S	Pre-load and damper valve (pre-load pressure: 25 bar)	
W	Pre-load and damper valve with increased throttle effect (pre-load pressure: 25 bar)	
E	Damper valve without pre-load valve  Because there is no pre-load valve, LS relief with all directional spool valves in neutral position occurs with a slight delay, system pressure drops only slowly. Common applications include consumers with a tendency to oscillate at low frequencies.	
G	Damper valve with increased throttle effect without pre-load valve  Because there is no pre-load valve, LS relief with all directional spool valves in neutral position occurs with a slight delay, system pressure drops only slowly. Common applications include consumers with a tendency to oscillate at low frequencies.	

**Table 6 Internal control oil supply**

Coding	Description	Circuit symbol
Without coding	Without internal control oil supply  For valve sections with manual, hydraulic or pneumatic actuation. Or for external control oil supply (required pilot pressure: 20 to 40 bar).	
1, 2	With internal control oil supply  For valve sections with electro-hydraulic actuation. Optionally, a small quantity of control oil can be siphoned from the Z port to supply externally connected additional valves. In this case, maximum permissible flow rate is 2 lpm.  <ul style="list-style-type: none"> <li>▪ 1: 20 bar pilot pressure</li> <li>▪ 2: 40 bar pilot pressure</li> </ul>	

**Table 7 LS relief or LS pressure limitation**

Coding	Description	Circuit symbol
Without coding	Without LS relief or LS pressure limitation	<div style="display: flex; justify-content: space-between;"> <span>(LS)</span> <span>(T)</span> </div>
F *	LS relief, open when unpowered (WN 1 F as per <a href="#">D 7470 A/1</a> )	(LS) (T)
D *	LS relief, closed when unpowered (WN 1 D as per <a href="#">D 7470 A/1</a> )	(LS) (T)
ZA ** ZAM ** ZAP **	LS relief, open when unpowered  <ul style="list-style-type: none"> <li>▪ <b>ZA:</b> EM 11 S as per <a href="#">D 7490/1</a></li> <li>▪ <b>ZAM:</b> with wing bolt for mechanical locking (EM 11 S-...-M)</li> <li>▪ <b>ZAP:</b> with button for manual override (EM 11 ST)</li> </ul>	(LS) (T)
VA **	LS relief, closed when unpowered (EM 11 V as per <a href="#">D 7490/1</a> )	(LS) (T)
Z ZM ZP	Proportional LS pressure limitation with ascending characteristic line  <ul style="list-style-type: none"> <li>▪ <b>Z:</b> EM 21 DSE as per <a href="#">D 7490/1 E</a></li> <li>▪ <b>ZM:</b> with wing bolt for mechanical locking (EM 21 DSE-...-M)</li> <li>▪ <b>ZP:</b> with button for manual override (EM 21 DSET)</li> </ul>	(LS) (T)
V	Proportional LS pressure limitation with descending characteristic line (EM 21 DE as per <a href="#">D 7490/1</a> )	(LS) (T)

**! NOTE**

- \* Only compatible with connection block PSL 3 Z.../D...-2
- \*\* Contains adapter for EM 2.. hole to EM 1....

**Table 8 System pressure limitation**

Coding	Description
Without coding	Without pressure-limiting valve.
/D...	With pressure-limiting valve. Pressure setting in bar (adjustment range 50 to 420 bar). Directly actuated.
/...	With pressure-limiting valve. Pressure setting in bar (adjustment range 50 to 420 bar). Pilot control of the 3-way controller via a pilot valve.
/.../...	With pressure-limiting valve and LS pressure-limiting valve (only for PSV 4 N and PSV UNF 4 N).  The first value is the setting for the main pressure-limiting valve, the second value is the setting for the LS pressure-limiting valve.

**Table 9 Size**

Coding	Description
- 2	Size 2

For size 3 see [D 7700-3](#) and size 5 see [D 7700-5](#)

**List of available connection block variants and combination options:**
**PSL connection blocks**

Type	P and R port as per ISO 228-1 or SAE J 514	Pressure-limiting valve	
		direct actuation	pilot-controlled
PSL 3.../D...-2	G 1/2	●	
PSL 3U.../...-2	G 1/2		●
PSL 3 Z.../D...-2	G 1/2	●	
PSL 3Y.../...-2	G 1/2	●	
PSL UNF 2.../D...-2	SAE-6 (3/4-16UNF 2B)	●	
PSL UNF 2U.../...-2	SAE-6 (3/4-16UNF 2B)		●

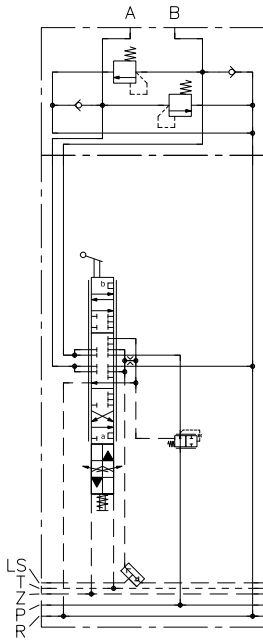
**PSV connection blocks**

Type	P and R port as per ISO 228-1 or SAE J 514	Pressure-limiting valve	
		without	direct actuation
PSV 3...-2	G 1/2	●	
PSV 3.../D...-2	G 1/2		●
PSV 4N.../.../...-2	G 3/4		●
PSV 3X...-2	G 1/2	●	
PSV UNF 2...-2	SAE-6 (3/4-16UNF 2B)	●	
PSV UNF 2.../D...-2	SAE-6 (3/4-16UNF 2B)		●
PSV UNF 4N.../.../...-2	SAE-12 (1 1/16-12 UN-2B)		●

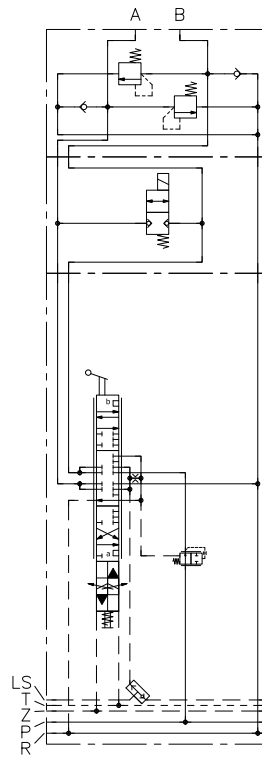
## 2.3 Valve section

Directional valve section always provided with a flange surface for configuring an ancillary block or an intermediate plate and ancillary block.

**Valve section  
with ancillary block**

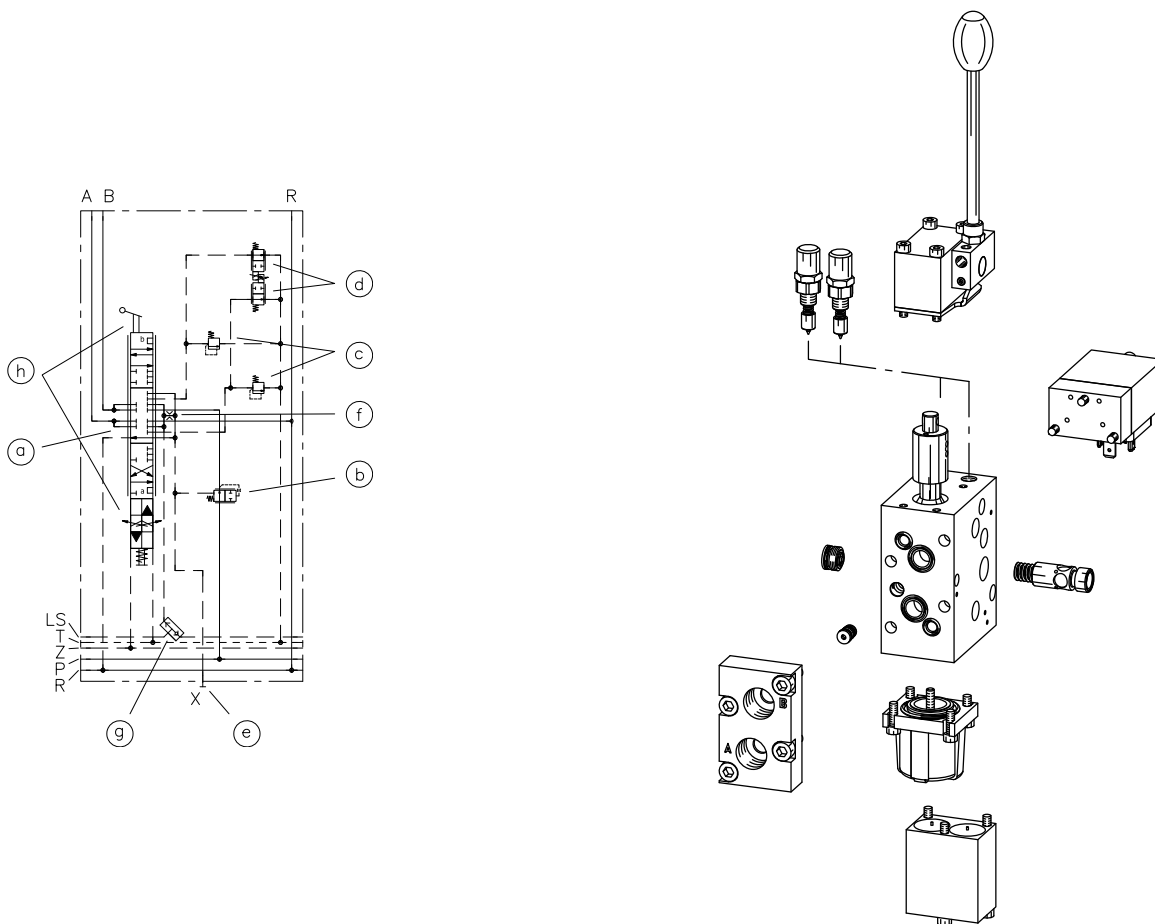


**Valve section  
with intermediate plate and ancillary  
block**





Depending on configuration, the directional valve sections incorporate:



- a. Valve spool for controlling proportional flow rate
- b. 2-way controller (pressure compensator) for controlling a constant pressure difference using the valve spool, irrespective of the load pressure and pump pressure
- c. Fixed LS pressure-limiting valves
- d. Electric LS pressure-limiting valves for relief or electro-proportional limitation of the LS pressure
- e. Additional connections for external LS pressure limitation
- f. LS orifice for damping the LS signal
- g. Shuttle valve for linking the LS line to additional valve sections
- h. Actuation for the control piston

Ordering example:

SL 2	- A	R2	H 40/40	A200 B300 F3 X	9	W1	L	/EA1	WA	/ZDRH	/2
------	-----	----	---------	----------------	---	----	---	------	----	-------	----

Ancillary block [Chapter 2.3.2](#)

Intermediate plate [Chapter 2.3.3](#)

Switching position monitoring, displacement transducer ["Table 24"](#)

- Actuation
- ["Table 22: Actuation"](#)
  - ["Table 23: Additional description for actuation"](#)

Additional functions ["Table 21"](#)

Shuttle valve ["Table 20"](#)

LS orifice ["Table 19"](#)

- LS pressure limitation
- ["Table 16: LS pressure limitation"](#)
  - ["Table 17: Electric LS pressure limitation"](#)
  - ["Table 18: LS port for external limitation "](#)

- Valve spool
- ["Table 14: Circuit symbol"](#)
  - ["Table 15: Flow rate"](#)

- Basic block
- ["Table 11: Valve section, 2-way controller"](#)
  - ["Table 12: 2-way controller spring"](#)
  - ["Table 13: 2-way controller damping"](#)

Consumer ports ["Table 10"](#)

## 2.3.1 Directional valve section

**Table 10 Consumer ports**

Coding	Description
A	Spool block without integrated thread for combining with an ancillary block ( <a href="#">Chapter 2.3.2</a> ) or an intermediate plate ( <a href="#">Chapter 2.3.3</a> ) and ancillary block

**Table 11 Valve section, 2-way controller**

Coding	Description	Circuit symbol
Without coding	Standard 2-way controller	
1	Without 2-way controller	--
R	2-way controller with check valve function.  In the event of a shortage in supply, the controller prevents return flow from the load line (A or B channel) to the P channel.  Only in conjunction with 2-way controller spring coding 2 and 5.	
D	2-way controller with release of pressure  The controller prevents pressure creep in the P channel between the 2-way controller and valve spool.  Common applications include consumers with very low load pressures and without additional check valves. With standard 2-way controllers, phantom movements may occur here. The pressure controller prevents this.  In applications with check valves, the pressure controller prevents undesired check valve intervention.	
B	2-way controller with release of pressure and check valve function  <b>Check valve function:</b> In the event of a shortage in supply, the controller prevents return flow from the load line (A or B channel) to the P channel.  <b>Release of pressure:</b> The controller prevents pressure creep in the P channel between the 2-way controller and valve spool.  Common applications include consumers with very low load pressures and without additional check valves. With standard 2-way controllers, phantom movements may occur here. The pressure controller prevents this.  In applications with check valves, the pressure controller prevents undesired check valve intervention.  Only in conjunction with 2-way controller spring coding 2 and 5 (see <a href="#">"Table 12"</a> ).	

**!** **NOTE**  
2-way controller depicted with applicable LS pressure.  
For B and R:  $LS > P$

**Coding**

8  
81

**Description**

Pre-selector valve section without 2-way controller.

The pre-selector valve section shuts off the P channel in neutral position. Once the pre-selector valve activates, it supplies either the downstream valve sections (switching position b) or a second manifold connected to port A (switching position a).

- **8:** LS signal is signalled from port A (switching position a) and the downstream valve section (switching position b). Standard configuration if an open centre valve is used on port A.
- **81:** LS signal is only signalled by downstream valve section (switching position b). Is used if a closed centre LS valve is connected to port A; the LS signal is then usually signalled externally to the variable pump.

Common applications include loading cranes, concrete line pumps and lifting platforms. In these, the pre-selector valve is used to switch between operating the crane or mast and the outriggers. The pre-selector valve can further also be used as a P-line cut off in safety functions.

**Only in conjunction with**

- PSL connection block with 3-way controller spring coding H (see "[Table 4](#)") or PSV connection block
- Circuit symbol L or H (see "[Table 14](#)")
- Actuation coding E... (see "[Table 22](#)")

**i NOTE**

When using a pre-selector valve, there is an additional pressure drop in the P channel that can lead to the downstream sections no longer reaching nominal flow.

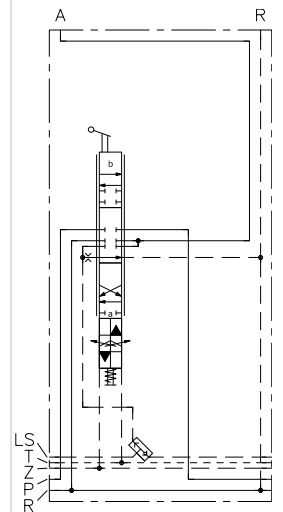
**Nominal flow undercut depends on**

- a) the control pressure difference of the 3-way controller (PSL) or variable pump's pump controller (PSV),
- b) the position of the valve sections in the manifold and
- c) the flow rate through the pre-selector valve or P-line cut off.

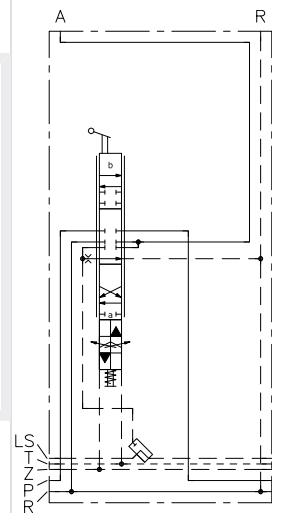
Nominal flow undercut can reach up to 30 % of  $Q_{\text{nominal}}$ , see "[Table 15: Flow rate](#)".

**Circuit symbol**

▪ 8



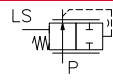
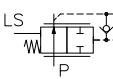
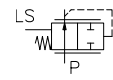
▪ 81



**Table 12 2-way controller spring**

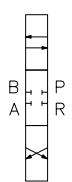
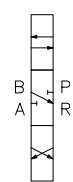
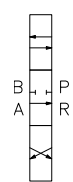
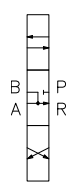
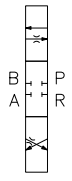
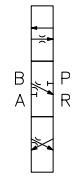
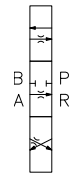
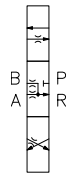
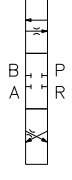
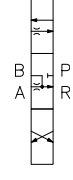
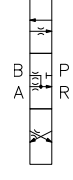
Coding	Description
<b>Without coding</b>	Without coding for configurations without 2-way controller (coding 1 or 8 as per <a href="#">"Table 11"</a> )
<b>2</b>	Standard version (6 bar spring)
<b>5</b>	Heavy-duty version (9 bar spring)  Only possible in conjunction with PSL connection block with 3-way controller spring coding H ( <a href="#">"Table 4"</a> ) or with PSV connection block
<b>7</b>	Heavy-duty version (13 bar spring)  Only possible in conjunction with PSV connection block

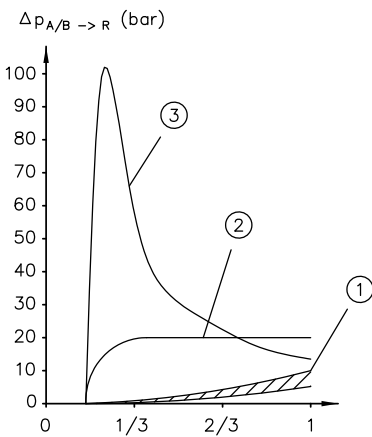
**Table 13 2-way controller damping**

Coding	Description	Circuit symbol
<b>Without coding</b>	Standard version (damping with $\varnothing$ 0.4 mm orifice)	
<b>S</b>	Special version with closing damping  Only in conjunction with standard 2-way controller (without designation) see <a href="#">"Table 11"</a>	
<b>X</b>	Special version without damping  Only in conjunction with standard 2-way controller (without designation) see <a href="#">"Table 11"</a>	

**!** **NOTE**  
2-way controller depicted with applicable LS pressure.

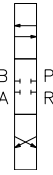

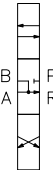
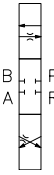



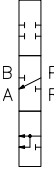
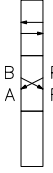
**Table 14 Circuit symbol**

Coding	Description	Circuit symbol			
L, M, F, H	Standard spool valve with low return pressure	L 	M 	F 	H 
J, B, R, O	Standard spool valve with constant return pressure 20 bar  Common applications: Stabilising cylinders with dragging loads, especially when used with load-holding valves or when used without additional check valves.	J 	B 	R 	O 
I, Y, V	Standard spool valve with high reflux at < 1/3 spool valve elevation and rapid subsequent return pressure drop  Common applications: Controlled deceleration of winches, slewing gear or other rotating consumers.	I 	Y 	V 	



- 1 Circuit symbols L, M, F, H
- 2 Circuit symbols J, B, R, O
- 3 Circuit symbols I, Y, V

**i NOTE**  
The return pressure is in relation to the nominal flow rate. It may be higher or lower than shown in the diagram depending on the cylinder ratio or 2-way controller spring.

Coding	Description	Circuit symbol				
LW, MW, HW, JW, OW	Special version with broad fitting tolerance. <ul style="list-style-type: none"> <li>▪ <b>Advantage:</b> Reduces risk of jamming spool valve in systems prone to soiling</li> <li>▪ <b>Drawback:</b> higher spool valve leak rate</li> </ul>					
LB	Special version with minimal release of pressure from A and B channel when spool valve in idle position. <p>Common applications:            Combined with load-holding valves that require closed spool valve in neutral position in line with safety requirements. The LB spool valve in such a case prevents trapping pressure between spool valve and load-holding valve and allows the load-holding valve to close reliably.</p>					
G	3/3-way directional spool valve for single-acting cylinders <p>The G spool valve can be combined with any valve section, port B is sealed with a tapped plug when doing so.</p> <p>No LS signal is produced when load drops. If used in conjunction with electro-hydraulic actuation and a PSL connection block with standard 3-way controller spring (see "Table 4"), this can result in the internally generated pilot pressure not being sufficient to fully shift the spool valve.</p> <p>Load reduction is throttled using the spool valve's outflow edge. If desired, the maximum reduction rate can be capped using a separate flow control valve (e.g. type SB as per D 6920).</p> <p>To obtain pressure-compensated load reduction, you can alternatively also use an N or NX spool valve.</p>					
X, W	Special spool valve in conjunction with P → A in neutral position <p>Common applications:            Fan drives, generator drives or other consumers requiring a specific flow rate when unpowered for safety reasons.</p> <ul style="list-style-type: none"> <li>▪ <b>X:</b> 2/2-way directional spool valve              Maximum flow rate in neutral position. By shifting the spool valve to switching position b, the flow rate can be reduced to zero proportionally.</li> <li>▪ <b>W:</b> 4/2-way directional spool valve              In neutral position, the maximum flow rate is towards A-side. By shifting the spool valve to switching position b, the direction is reversed and the flow rate is towards B-side. Decelerating consumer to zero as well as proportional flow rate control are only possible to a limited degree. This makes the W spool valve suitable primarily for applications with constant speed.</li> </ul> <p><b>Available versions:</b></p> <ul style="list-style-type: none"> <li>▪ X 40</li> <li>▪ W 30/30</li> </ul>					



**NOTE**

You can find instructions on how to replace the valve spool in [Chapter 5.2.4, "Notes on spool valve exchange"](#).

**Table 15 Flow rate**

Coding 2-way controller spring as per " <a href="#">Table 12</a> "	Flow rate at maximum spool valve elevation ( $Q_{A/B}$ in lpm) according to flow rate coding ( $Q_{nominal}$ )					
	3	6	10	16	25	40
2	3	6	10	16	25	40
5	4	9	14	22	34	54
7	5	10	15	24	37	59

**! NOTE**

The valve spools' sizes are designed to make actual flow rate slightly higher than  $Q_{nominal}$  in practice. You can use stroke limitation to limit the maximum flow rate. Setting values are specified in lpm.

**Ordering example:** SL 2-A2 L 40/40/EA [35/30]

**! NOTE**

When using a pre-selector valve (coding 8 as per "[Table 11: Valve section, 2-way controller](#)") or a P-line cut off (coding PSV 4 N or PSV UNF 4 N as per "[Table 3: Connection block basic types](#)"), there is an additional pressure drop in the P channel that can lead to the downstream sections no longer reaching nominal flow.

**Nominal flow undercut depends on**

- a) the control pressure difference of the 3-way controller (PSL) or variable pump's pump controller (PSV),
- b) the position of the valve sections in the manifold and
- c) the flow rate passing through the pre-selector valve or P-line cut off or intermediate plate to P pressure limitation.

Nominal flow undercut can reach up to 30% of  $Q_{nominal}$ , see "[Table 15: Flow rate](#)".

With valve sections without 2-way controllers (coding 1 or 8 for  $Q_{A/B}$  as per "[Table 11](#)"), it is possible to calculate the flow rate using the following formula:

$$Q_{A/B} = Q_{Nominal} \cdot \sqrt{0.2 \cdot \Delta p_{Controller}}$$

$Q_{A/B}$  = flow rate to port A or B

$Q_{nominal}$  = nominal flow rate of valve spool at pressure difference of 6 bar

$\Delta p_{controller}$  = control pressure difference of the 3-way controller (PSL) or variable pump's pump controller (PSV)

**Example:**

- PSL connection block, standard 3-way controller spring (9 bar)

$$Q_{A/B} = 40 \text{ l/min} \cdot \sqrt{0.2 \cdot 9} = 54 \text{ l/min}$$

- PSL connection block, 3-way controller with heavy-duty spring (14 bar)

$$Q_{A/B} = 40 \text{ l/min} \cdot \sqrt{0.2 \cdot 14} = 67 \text{ l/min}$$

- PSV connection block, pump controller with 25 bar standby pressure

$$Q_{A/B} = 40 \text{ l/min} \cdot \sqrt{0.2 \cdot 25} = 89 \text{ l/min}$$

**! NOTE**

The calculated values are rough reference values! They apply only to the highest-load consumer. If multiple consumers are being actuated in parallel, the pressure difference may be considerably greater at the lower-load consumers.

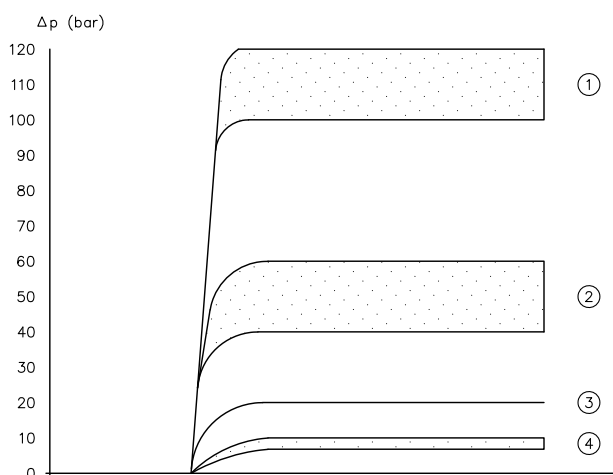


For spool valves with 2-digit order coding, the first number indicates nominal flow rate on the A-side ( $Q_A$ ) and the second number indicates nominal flow rate on the B-side ( $Q_B$ ). The shape of the spool valve's two outflow edges is defined by the circuit symbol (see "Table 14").

► **Ordering example:** L 40/25, J 25/16, H 40/40, O 10/10

For J and O spool valves, the outflow edge can also be customised. In such a case, the order coding has 4 digits and looks like this:  $Q_{A \rightarrow R} - Q_{P \rightarrow A} / Q_{P \rightarrow B} - Q_{B \rightarrow R}$ . Choosing a lower key figure increases return pressure. A larger key figure reduces return pressure.

► **Ordering example:** J 25-40/25-16, J 16-25/40-25, O 3-6/6-3, O 16-25/25-16

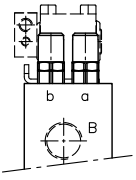


- 1 Outflow edge two sizes smaller
- 2 Outflow edge one size smaller
- 3 Standard version
- 4 Outflow edge one size larger

**NOTE**

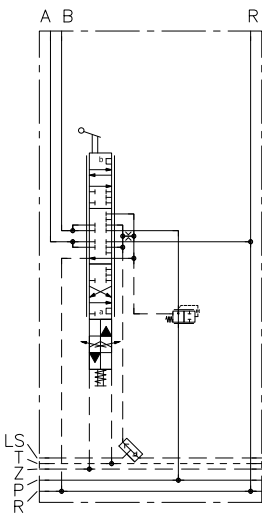
The return pressure is in relation to the nominal flow rate. It may be higher or lower than shown in the diagram depending on the cylinder ratio or 2-way controller spring.

**Table 16 LS pressure limitation**

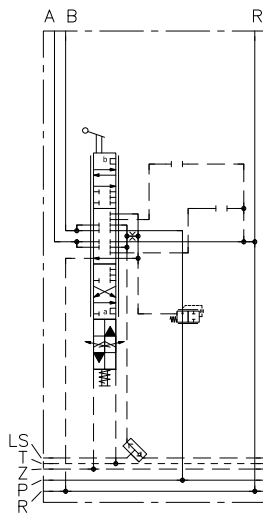
Coding	Description	
Without coding	Without LS pressure limitation	--
AB	Without LS pressure limitation, but prepared for later conversion to coding A..., B... or A... B...	
A...	LS pressure limitation for A-side (Adjustment range: 50 to 400 bar)	
B...	LS pressure limitation for B-side (Adjustment range: 50 to 400 bar)	
A... B...	LS pressure limitation for A and B-side with two separate pressure settings (Adjustment range: 50 to 400 bar)	

**Circuit symbols**

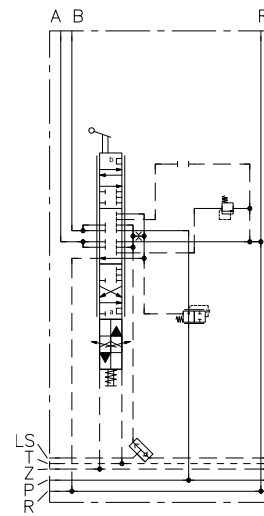
No designation



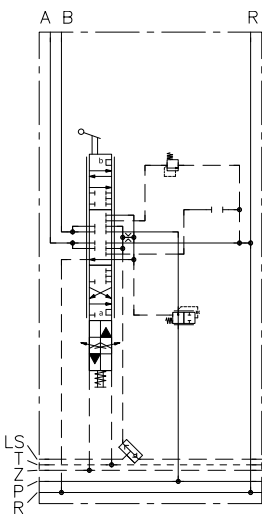
**AB**



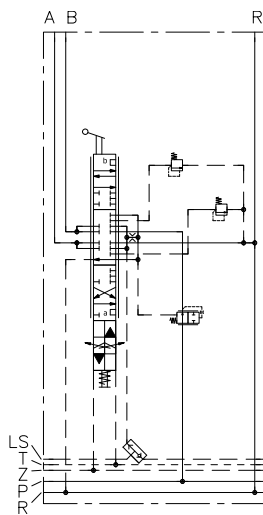
**A...**



**B...**



**A... B...**

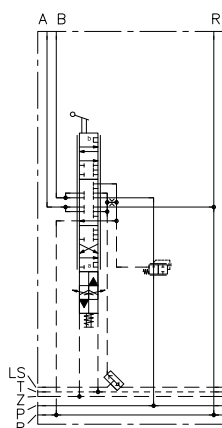


**Table 17 Electric LS relief or LS pressure limitation**

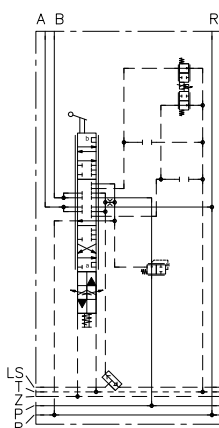
Coding	Description
Without coding	Without electric LS relief or LS pressure limitation
FP... FPH...	<p>Electro-proportional LS pressure limitation with ascending characteristic line</p> <p><b>Pressure ranges for A and for B-side:</b></p> <ul style="list-style-type: none"> <li>▪ 1 = 10 to 100 bar</li> <li>▪ 2 = 15 to 150 bar</li> <li>▪ 4 = 30 to 250 bar</li> <li>▪ 6 = 40 to 350 bar</li> </ul> <p>The first number applies to A-side. The second number applies to B-side.  <b>Ordering example:</b> FP 14</p> <ul style="list-style-type: none"> <li>▪ <b>FPH..:</b> additionally with button for manual override</li> </ul> <p>Only in conjunction with actuation coding E... (see <a href="#">"Table 22"</a>)</p>

**Circuit symbols**

No designation



FP..., FPH...


**NOTE**

 Electric LS relief or LS pressure limitation is only possible in conjunction with a 2-way controller (see ["Table 11"](#)).

**NOTE**

 Even with LS relief, pressure in consumer channel A or B cannot be reduced completely to 0 bar. The residual pressure in A or B ( $p_{\min, A/B}$ ) results from

- a) control pressure in the 2-way controller ( $\Delta p_{2\text{-way controller}}$ ),
- b) internal dynamic pressure in block ( $\Delta p_{\text{Block}}$ ) and
- c) return pressure in T channel ( $p_T$ ).

$$p_{\min, A/B} = \Delta p_{2\text{-way controller}} + \Delta p_{\text{Block}} + p_T$$

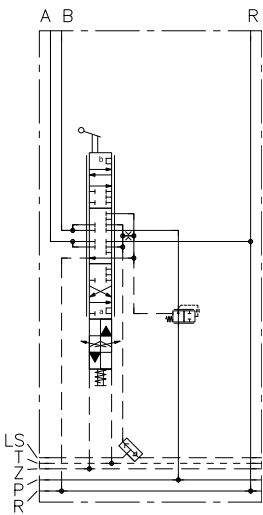
 $\Delta p_{2\text{-way controller}}$ : see ["Table 12"](#)
 $\Delta p_{\text{Block}} = 10 \text{ bar}$  with coding FP..., FPH...

**Table 18 LS port for external limitation**

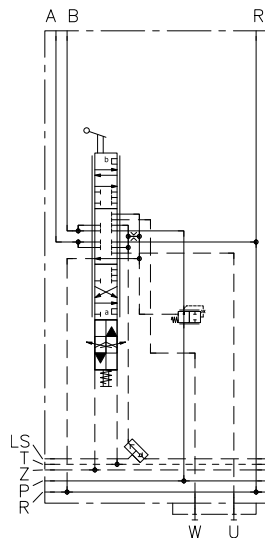
Coding	Description
Without coding	Without LS port for external limitation
S1 S1 UNF	<p>U and W port for connecting external pilot valve</p> <ul style="list-style-type: none"> <li>▪ U port = LS<sub>A</sub></li> <li>▪ W port = LS<sub>B</sub></li> </ul> <ul style="list-style-type: none"> <li>▪ S1: G 1/8 (ISO 228-1)</li> <li>▪ S1 UNF: SAE-2 or 5/16-24 UNF-2B</li> </ul> <p><b>Only in conjunction with</b></p> <ul style="list-style-type: none"> <li>▪ Actuation coding E... (see "Table 22")</li> </ul>

**Circuit symbols**

No designation



S1, S1 UNF



**i NOTE**

An LS port for external limitation is only possible in conjunction with a 2-way controller (see "Table 11").

**i NOTE**

Even with LS relief, pressure in consumer channel A or B cannot be reduced completely to 0 bar. The residual pressure in A or B ( $p_{\min, A/B}$ ) results from

- a) control pressure in the 2-way controller ( $\Delta p_{2\text{-way controller}}$ ),
- b) internal dynamic pressure in block ( $\Delta p_{\text{Block}}$ ) and
- c) return pressure ( $p_{\text{reflux}}$ ).

$$p_{\min, A/B} = \Delta p_{2\text{-way controller}} + \Delta p_{\text{Block}} + p_{\text{reflux}}$$

$\Delta p_{2\text{-way controller}}$ : see "Table 12"

$\Delta p_{\text{Block}}$  with coding S1 = 5 bar

**Table 19 LS orifice**

Coding	Description
Without coding	Standard version with $\varnothing$ 0.6 mm orifice

**Table 20 Shuttle valve**

Coding	Description	Circuit symbol
Without coding	Standard version	
W3	Special version without ball  Only useful in manifold's final valve section in case the downstream LS gallery is not relieved by the end plate.	

**Table 21 Additional functions**



Coding	Description	Circuit symbol
L	Valve section with additional LS port facing ancillary block.  The LS signal is picked up upstream of the LS orifice.	
FL	Valve section with additional 1-, 2-, X- and Z-port facing ancillary block  The Z port can be used to realise additional functions for an ancillary block or intermediate plate.  The LS signal is picked up downstream of the LS orifice.  <b>NOTE</b> <ul style="list-style-type: none"> <li>HAWE does not currently have any intermediate plates (see <a href="#">Chapter 2.3.3</a>) or ancillary blocks (see <a href="#">Chapter 2.3.2</a>) available for this function</li> <li>Only with return pressure &lt; 10 bar (similar to end plate E4)</li> <li>There are around 2 lpm available for Z; it must be ensured that there is sufficient oil available for the actuation</li> </ul>	

**Table 22 Actuation**

The different actuation types can be combined with one another.

Coding	Description	Circuit symbol
<b>Electro-hydraulically prepared</b>		
EO	Prepared for electro-hydraulic actuation	--
<b>Manual actuation</b>		
A	<p>Manual operation with spring return</p> <p><b>Only in conjunction with actuation variants:</b></p> <ul style="list-style-type: none"> <li>▪ EA</li> <li>▪ EACAN(L)</li> <li>▪ EMA</li> <li>▪ EMACAN(L)</li> <li>▪ EOA</li> <li>▪ EOZA</li> <li>▪ EOHA</li> <li>▪ EHA</li> <li>▪ EHACAN</li> <li>▪ EOZMA</li> <li>▪ EAR</li> <li>▪ EOAR</li> </ul>	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>EOA</p> </div> <div style="text-align: center;"> <p>EOC</p> </div> <div style="text-align: center;"> <p>EOAR</p> </div> </div>
C	<p>Manual actuation with stepless detent.</p> <p><b>Only in conjunction with actuation variants:</b></p> <ul style="list-style-type: none"> <li>▪ EOC</li> </ul>	<p>EOK</p>
R	<p>Actuation add-on with 3-step detent in neutral position, a or b. With spring return.</p> <p>Without stroke limitation. No flow rate setting possible.</p> <p><b>Only in conjunction with actuation variants:</b></p> <ul style="list-style-type: none"> <li>▪ EAR</li> <li>▪ ER</li> <li>▪ EOAR</li> </ul>	
K	<p>Joystick actuation</p> <p>Combination manual operation for two adjacent sections with shared dual-axis actuation.</p> <p><b>Only in conjunction with actuation variants:</b></p> <ul style="list-style-type: none"> <li>▪ EOK</li> </ul>	

Coding	Description	Circuit symbol
<b>Electro-hydraulic actuation</b>		
<b>E</b> <b>EI</b> <b>EM</b> <b>EM UNF</b>	<p>Electro-hydraulic actuation.</p> <ul style="list-style-type: none"> <li>▪ <b>E:</b> with stroke limitation</li> <li>▪ <b>EI:</b> no stroke limitation</li> <li>▪ <b>EM:</b> with measurement fitting, with stroke limitation</li> <li>▪ <b>EM:</b> G 1/8 (ISO 228-1)</li> <li>▪ <b>EM UNF:</b> SAE-2 or 5/16-24 UNF-2B</li> </ul> <p><b>Only in conjunction with actuation variants:</b></p> <ul style="list-style-type: none"> <li>▪ <b>E</b></li> <li>▪ <b>ECAN(L)</b></li> <li>▪ <b>EI</b></li> <li>▪ <b>EICAN(L)</b></li> <li>▪ <b>EA</b></li> <li>▪ <b>EACAN(L)</b></li> <li>▪ <b>EMA</b></li> <li>▪ <b>EMACAN(L)</b></li> <li>▪ <b>EHA</b></li> <li>▪ <b>EHACAN</b></li> <li>▪ <b>ER</b></li> <li>▪ <b>EAR</b></li> </ul>	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p><b>E</b></p> </div> <div style="text-align: center;"> <p><b>EA</b></p> </div> <div style="text-align: center;"> <p><b>EI</b></p> </div> </div> <div style="display: flex; justify-content: space-around; margin-top: 20px;"> <div style="text-align: center;"> <p><b>ER</b></p> </div> <div style="text-align: center;"> <p><b>EM</b></p> </div> </div>
<b>CAN actuation</b>		
<b>CAN</b> <b>CANL</b>	<p>Directly mounted CAN controls.</p> <p><b>Only in conjunction with actuation variants:</b></p> <ul style="list-style-type: none"> <li>▪ <b>ECAN(L)</b></li> <li>▪ <b>EICAN(L)</b></li> <li>▪ <b>EACAN(L)</b></li> <li>▪ <b>EMACAN(L)</b></li> <li>▪ <b>EHACAN</b></li> </ul>	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p><b>EACAN</b></p> </div> <div style="text-align: center;"> <p><b>ECANL</b></p> </div> </div>
<b>Hydraulic actuation</b>		
<b>HA</b> <b>HA UNF</b>	<p>Combination of hydraulic and manual actuation with control pressure connections on the spring housing and lever housing. With stroke limitation.</p> <p>Ports 1 and 2 parallel to spool valve axis.</p> <ul style="list-style-type: none"> <li>▪ <b>HA:</b> G 1/8 (ISO 228-1)</li> <li>▪ <b>HA UNF:</b> SAE-2 or 5/16-24 UNF-2B</li> </ul> <p><b>Only in conjunction with actuation variants:</b></p> <ul style="list-style-type: none"> <li>▪ <b>EOHA</b></li> <li>▪ <b>EHA</b></li> <li>▪ <b>EHACAN</b></li> </ul>	<div style="text-align: center;"> <p><b>EHA</b></p> </div>

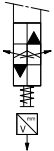
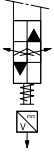
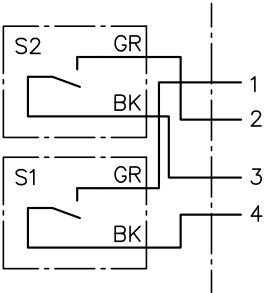

Coding	Description	Circuit symbol	
<p>Z Z UNF</p>	<p>Hydraulic actuation with control pressure connections in the spool block beneath spring housing.</p> <ul style="list-style-type: none"> <li>▪ <b>Z:</b> G 1/8 (ISO 228-1)</li> <li>▪ <b>Z UNF:</b> SAE-2 or 5/16-24 UNF-2B</li> </ul> <p><b>Only in conjunction with actuation variants:</b></p> <ul style="list-style-type: none"> <li>▪ <b>EOZ</b></li> <li>▪ <b>EOZI</b></li> <li>▪ <b>EOZA</b></li> <li>▪ <b>EOZA UNF</b></li> <li>▪ <b>EOZMA</b></li> <li>▪ <b>EOZMA UNF</b></li> </ul>	<p>EOZ</p> 	<p>EOZMA</p> 

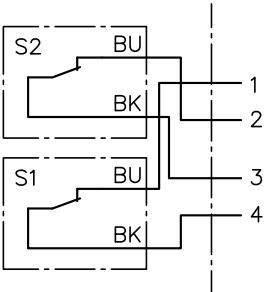

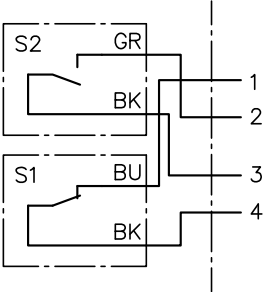



**Table 23 Additional elements for actuation**

Coding	Description
Without coding	Standard version Hand lever straight approx. 122 mm
1	Add-on for manual actuation A
2	<ul style="list-style-type: none"> <li>1: without lever arm</li> </ul>
3	<ul style="list-style-type: none"> <li>2: Hand lever straight approx. 78 mm</li> </ul>
4	<ul style="list-style-type: none"> <li>3: Hand lever straight approx. 174 mm</li> </ul>
005	<ul style="list-style-type: none"> <li>4: Hand lever straight approx. 92 mm</li> </ul>
015	<ul style="list-style-type: none"> <li>005: Hand lever 5° curved approx. 122 mm</li> </ul>
025	<ul style="list-style-type: none"> <li>015: Hand lever 15° curved approx. 120 mm</li> </ul>
030	<ul style="list-style-type: none"> <li>025: Hand lever 25° curved approx. 115 mm</li> <li>030: Hand lever 30° curved approx. 114 mm</li> </ul>
S	Reinforced version of spring housing made from steel (seaworthy version).
7	Spring package from actuation A
8	Spring package from actuation E
9	Spring package from actuation H
BE...	Add-on for actuation E0Z, E0ZA With restrictor check valve as per <a href="#">D 7555 B</a> in the ports  <b>Ordering example:</b> SL 2 A2 H16/16/E0Z BE0606
00	Add-on for actuation E
04	Additional damping in the electro-hydraulic pilot control.
05	<ul style="list-style-type: none"> <li>Without coding - 0.8 mm orifice</li> <li>Coding 00 - no orifice (open)</li> <li>Coding 04 - 0.4 mm orifice</li> <li>Coding 05 - 0.5 mm orifice</li> <li>Coding 06 - 0.6 mm orifice</li> <li>Coding 07 - 0.7 mm orifice</li> </ul>
06	
07	
	<b>Ordering example:</b> SL 2 A2 H16/16/E0Z 07 (if A and B are equal, here 0.7 mm orifice)  SL 2 A2 H16/16/E0Z 0705 (if A and B are different, here 0.7 mm orifice for A and 0.5 mm orifice for B)

**Table 24 Switching position monitoring and displacement transducer**

Coding	Description	Circuit symbol
<p><b>U</b></p>	<p>Comparator for monitoring switching position.</p> <ul style="list-style-type: none"> <li>▪ In neutral position: A and B on</li> <li>▪ P → A: A on, B off</li> <li>▪ P → B: A off, B on</li> <li>▪ Voltage U: 10 – 32 V DC</li> </ul> <p>Connector types: X</p> <p><b>Ordering example:</b> SL 2 A2 H16/16/EAU</p> <p><b>Only in conjunction with</b></p> <ul style="list-style-type: none"> <li>▪ Actuation coding E, EI, EA, E0Z, E0ZI, E0ZA, E0A, E0C and E0K (see <a href="#">"Table 22"</a>)</li> </ul>	
<p><b>WA</b></p>	<p>Integrated displacement transducer (Hall sensor) for spool valve position monitoring with analogue output signal. Connector types: X, G, DT, C</p> <p><b>Ordering example:</b> SL 2 A2 H16/16/EAWA</p> <div style="border: 1px solid gray; padding: 5px; margin: 10px 0;"> <p><b>NOTE</b></p> <ul style="list-style-type: none"> <li>▪ Not possible in the first valve section if an LS pressure limitation or LS release valve with coding V, Z or ZM is selected in the connection block. The electric field of the solenoid influences the displacement transducer.</li> </ul> </div> <p><b>Only in conjunction with</b></p> <ul style="list-style-type: none"> <li>▪ Actuation coding E (see <a href="#">"Table 22"</a>) is the stroke limitation only possible for consumer A.</li> </ul>	
<p><b>VCHO</b> <b>VCHO2K</b></p>	<p>Contact switch for monitoring the switching position.</p> <p>Direction detection: Direction A (S2) as normally open contact Direction B (S1) as normally open contact</p>  <ul style="list-style-type: none"> <li>▪ <b>VCHO:</b> With connector, without cable</li> <li>▪ <b>VCHO2K:</b> With connector and 2-m cable</li> </ul> <p><b>Ordering example:</b> SL 2 A2 H16/16/EAVCHO</p> <p><b>Only in conjunction with</b></p> <ul style="list-style-type: none"> <li>▪ Actuation coding EA, EAR, ER, E0ZA, E0A, E0C and E0AR (see <a href="#">"Table 22"</a>)</li> </ul>	

Coding	Description	Circuit symbol
<p><b>VCHC</b> <b>VCHC2K</b></p>	<p>Contact switch for monitoring the switching position.</p> <p>Direction detection:            Direction A (S2) as N/C contact            Direction B (S1) as N/C contact</p>  <ul style="list-style-type: none"> <li>▪ <b>VCHC:</b> With connector, without cable</li> <li>▪ <b>VCHC2K:</b> With connector and 2-m cable</li> </ul> <p><b>Ordering example:</b> SL 2 A2 H16/16/EAVCHC</p> <p><b>Only in conjunction with</b></p> <ul style="list-style-type: none"> <li>▪ Actuation coding EA, EAR, ER, EOZA, EOA, EOC and EOAR (see <a href="#">"Table 22"</a>)</li> </ul>	
<p><b>VCHOC</b> <b>VCHOC2K</b></p>	<p>Contact switch for monitoring the switching position.</p> <p>Direction detection:            Direction A (S2) as normally open contact            Direction B (S1) as N/C contact</p>  <ul style="list-style-type: none"> <li>▪ <b>VCHOC:</b> With connector, without cable</li> <li>▪ <b>VCHOC2K:</b> With connector and 2-m cable</li> </ul> <p><b>Ordering example:</b> SL 2 A2 H16/16/EAVCHOC</p> <p><b>Only in conjunction with</b></p> <ul style="list-style-type: none"> <li>▪ Actuation coding EA, EAR, ER, EOZA, EOA, EOC and EOAR (see <a href="#">"Table 22"</a>)</li> </ul>	

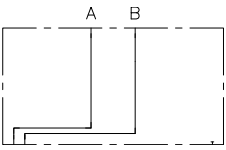
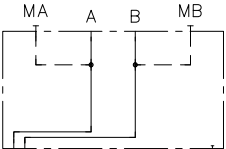
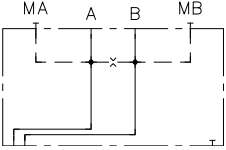
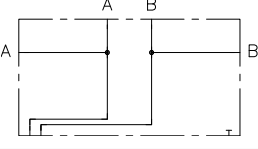
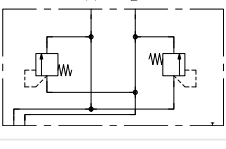
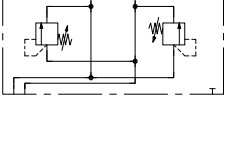
## 2.3.2 Ancillary block

Depending on their version, the ancillary blocks comprise different kinds of additional valves (e.g. shock valves, releasable check valves, load-holding valves or electrically actuated 2/2-way directional seated valves). They can be flange-mounted either on a valve section with flange surface (coding A as per ["Table 10: Consumer ports"](#)) or on an intermediate plate ([Chapter 2.3.3](#)).

**Ports A and B as per ISO 228-1 or SAE J 514 or JIS B 2351:**

- /2: G 3/8
- /22: G 3/8 (more distance between consumer ports A and B)
- /3: G 1/2
- /4: G 3/4
- /UNF 1: 7/16-20 UNF-2B (SAE-4)
- /UNF 12: 9/16-18 UNF-2B (SAE-6)
- /UNF 2: 3/4-16 UNF-2B (SAE-8)
- /JIS 2: JIS G 3/8
- /M 222: M22x1.5 and G 3/8

**Table 25 Ancillary block**

Coding	Description	Circuit symbol
/2 /22 /3 /UNF 1 /UNF 12 /UNF 2 /JIS 2	No additional function	
/2 M /UNF 2 M	Additional measurement fittings a and b G 1/4.	
/2 M-..	Connection A - B via orifice. Additional measurement fittings a and b G 1/4.  <b>Ordering example:</b> SL 2-/ M-06	
/M 222	Consumer ports A and B in M22x1.5 mm. Additional A and B ports laterally G 3/8.	
/2 AS.. BS.. /22 AS.. BS.. /UNF 2 AS.. BS..	Fixed shock valve in A and B. (Adjustment range: 40 to 420 bar)  The shock valves are each connected to their opposite side.	
/2 AS..R BS..R	Adjustable shock valve in A and B. (Adjustment range: 40 to 420 bar)  The shock valves are each connected to their opposite side.	

Coding	Description	Circuit symbol
/2 AN.. BN.. /22 AN.. BN.. /UNF 2 AN.. BN..	Fixed shock and anti-cavitation valves in A and B. (Adjustment range: 40 to 420 bar)  The shock and anti-cavitation valves are each connected to the reflux. Common applications: Pressure safeguard in hydraulic cylinders.  <ul style="list-style-type: none"> <li>▪ /22 AN.. BN..: Greater distance between consumer ports A and B than for coding /2</li> </ul>	
/22 AN.. /UNF 2 AN..	Fixed shock valve in A and anti-cavitation valves B.  <ul style="list-style-type: none"> <li>▪ /22 AN..: Greater distance between consumer ports A and B</li> </ul>	
/22 BN.. /UNF 2 BN..	Fixed shock valve in B and anti-cavitation valves A.  <ul style="list-style-type: none"> <li>▪ /22 AN..: Greater distance between consumer ports A and B</li> </ul>	
/2 A HN	Manual short-circuit valve for connection A to B. Manual drain valve A to R.	
/2 B HN	Manual short-circuit valve for connection A to B. Manual drain valve B to R.	

**Coding**

**Description**

**Circuit symbol**

/2 AL-0-..-BL-0-..  
/2 ALX-0-..-BLX-0-..  
/UNF 2 AL-0-..-BL-0-..  
/UNF 2 ALX-0-..-BLX-0-..  
  
/2 AL-0-..  
/2 ALX-0-..  
/UNF 2 AL-0-..  
/UNF 2 ALX-0-..  
  
/2 BL-0-..  
/2 BLX-0-..  
/UNF 2 BL-0-..  
/UNF 2 BLX-0-..

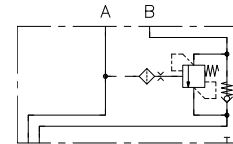
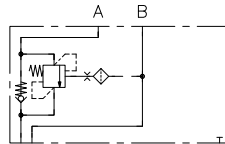
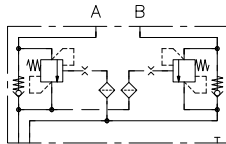
Load-holding valve (type LHT 20 as per [D 7918](#)).

- /2 AL-0-..-BL-0-..: Load-holding valves in A and B
- /2 AL-0-..: Load-holding valve in A
- /3 BL-0-..: Load-holding valve in B
- AL or BL: Pressure setting adjustable from the outside using a tool
- ALX or BLX: fixed

/ (UNF) 2 AL-0-..BL-0-..  
/ (UNF) 2 ALX-0-..-BLX-0-..

/ (UNF) 2 AL-0-..  
/ (UNF) 2 ALX-0-..

/ (UNF) 2 BL-0-..  
/ (UNF) 2 BLX-0-..



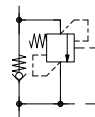
**Ordering example:**

/2 AL - 0 - A 8 - 400

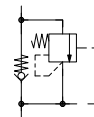
Flow rate  
Geometric pilot ratio  
Pressure setting in bar

- **Geometric pilot ratio:**
  - 1:∞ (coding 0)
  - 1:4 (coding 4)
  - 1:8 (coding 8)

**Coding 4, 8**



**Coding 0**



For coding 0, the load pressure has no effect, and the load-holding valve is opened by the pilot pressure alone. In this case, the load-holding valve does not have an overpressure function. The set pressure corresponds to the pilot pressure.

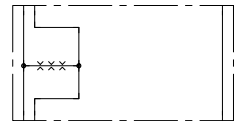

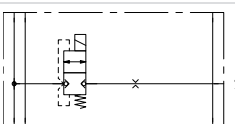
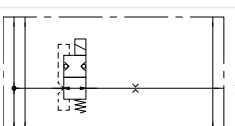
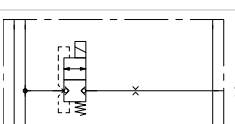
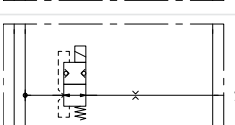
- **Flow rate:**

Coding	A	AB	B	C	D	E
Q <sub>max</sub> (lpm)	28	20	14	10	6	3

Coding	Description	Circuit symbol
/2 DRH /UNF 2 DRH	Releasable check valves (type DRH 2 as per <a href="#">D 6110</a> ) <ul style="list-style-type: none"> <li>▪ /2 DRH: releasable check valves in A and B</li> <li>▪ /2 DRH A: releasable check valves in A</li> <li>▪ /2 DRH B: releasable check valves in B</li> </ul>	
/2 DRH A /UNF 2 DRH A	<b>Pressure required for releasing:</b> <ul style="list-style-type: none"> <li>▪ 0.4-fold of checked pressure + 3 bar</li> </ul>	
/2 DRH B /UNF 2 DRH B		
/3 AVT /3 AVPT	Electrically actuated 2/2-way directional seated valve closed in neutral position. (Type according to <a href="#">D 7490/1</a> ) With manual override function. <p><b>On/off actuated (with type EM 22 V)</b></p> <ul style="list-style-type: none"> <li>▪ /3 AVT: Check valve in A</li> <li>▪ /3 BVT: Check valve in B</li> </ul> <p><b>Proportional (with type EMP 21 V)</b></p> <ul style="list-style-type: none"> <li>▪ /3 AVPT: Check valve in A</li> <li>▪ /3 BVPT: Check valve in B</li> </ul>	<p style="text-align: center;">/3 AVT</p> <p style="text-align: center;">/3 AVPT</p>
/3 BVT /3 BVPT	<p><b>! NOTE</b> The actuation of the override function is only possible up to approx. 100 bar.</p>	<p style="text-align: center;">/3 BVT</p> <p style="text-align: center;">/3 BVPT</p>
/32 DFA	Differential function.  The differential circuit (regeneration function) makes it possible to reach considerably greater cylinder extension speeds at the same pump flow rate.	
/32 DFB	At the same time, however, the force available becomes lower because the pressure applied on the cylinder's piston and rod side is identical; only the effective areas differ. This makes the differential function unsuitable for loads that drag on the cylinder. <ul style="list-style-type: none"> <li>▪ /32 DFA: cylinder's piston side on A-side, rod side on B-side</li> <li>▪ /32 DFB: cylinder's piston side on B-side, rod side on A-side</li> </ul> <p>Formula for calculating the required pump flow rate (<math>Q_{\text{pump}}</math>) as a function of desired flow rate for cylinder extension (<math>Q_{\text{piston}}</math>) and cylinder ratio (<math>\phi</math>):</p> $Q_{\text{Pumpe}} = Q_{\text{Kolben}} \cdot \left(1 - \frac{1}{\phi}\right)$	

## 2.3.3 Intermediate plate (on the consumer side)

Table 26 Intermediate plate

Coding	Description	Circuit symbol
/Z 20	Connection of A and B via 3 orifices (2 mm, 1.2 mm, 2 mm)	
/Z 40	Spacer plate, height 40 mm, for compensating height differences between adjacent valve sections.	
/Z2A BVE 1 R B..	Additional port S in A or B. <ul style="list-style-type: none"> <li>▪ /Z2A BVE 1 R B.. and /Z2B BVE 1 R B..: closed when unpowered</li> <li>▪ /Z2A BVE 1 S B.. and /Z2B BVE 1 S B..: open when unpowered</li> </ul>	
/Z2A BVE 1 S B..	<b>Selectable orifices for volume limitation:</b> <ul style="list-style-type: none"> <li>- Ød: 0.4 / 0.5 / 0.6 / 0.7 / 0.8 / 0.9 / 1.0 / 1.2 / 1.5 mm</li> <li>- Q<sub>max</sub> = 15 lpm</li> </ul>	
/Z2B BVE 1 R B..	$d = \sqrt{\frac{2,24 \times Q}{\sqrt{\Delta p}}}$	
/Z2B BVE 1 S B..	<b>Ordering example:</b> /Z2A BVE 1 R B 0.8	



**Coding**
**Description**

/Z AL.. BL..  
/Z ALX.. BLX..

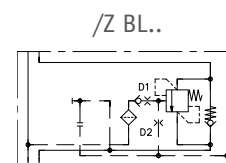
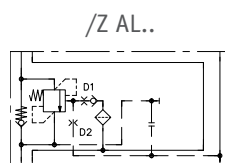
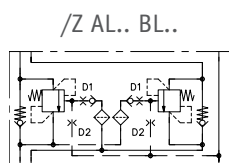
Load-holding valve (type LHT 20 as per [D 7918](#)).

/Z AL..  
/Z ALX..

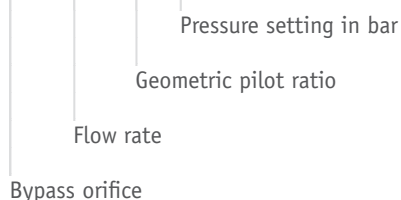
- /Z AL.. BL...: Load-holding valves in A and B
- /Z AL-...: Load-holding valve in A
- /Z BL-...: Load-holding valve in B

- /Z AL or /Z BL: Pressure setting adjustable from the outside using a tool
- /Z ALX or /Z BLX: fixed

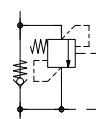
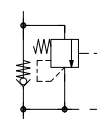
/Z BL..  
/Z BLX..


**Ordering example:**

/ZAL - 0 - A 8 - 400



- Inflow orifice D1:
  - Ø 0.4 mm
- Bypass orifice D2:
  - 0 = sealed
  - Ø 0.3 / 0.4 / 0.5 / 0.6 / 0.7 mm
- Geometric pilot ratio:
  - 1:∞ (coding 0)
  - 1:4 (coding 4)
  - 1:8 (coding 8)

**Coding 7**

**Coding 0**


For coding 0, the load pressure has no effect, and the load-holding valve is opened by the pilot pressure alone. In this case, the load-holding valve does not have an overpressure function. The set pressure corresponds to the pilot pressure.

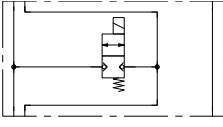
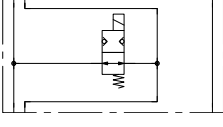
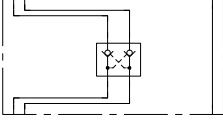
**Actual pilot ratio depends on bypass orifice:**

Coding		0	3	4	5	6	7
Bypass orifice Ø (mm)		sealed	0.3	0.4	0.5	0.6	0.7
Actual pilot ratio	at 1:4	1:4	1:3.04	1:2.0	1:1.16	1:0.66	1:0.39
	at 1:8	1:8	1:6.08	1:4.0	1:2.32	1:0.77	1:0.47

**Flow rate:**

Coding	A	AB	B	C	D	E
Q <sub>max</sub> (lpm)	28	20	14	10	6	3

Anti-cavitation valve in A and B.

Coding	Description	Circuit symbol
/ZDR	<p>Electrically actuated 2/2-way directional seated valve as short-circuit valve.  <math>Q_{max} = 20 \text{ lpm}</math></p> <ul style="list-style-type: none"> <li>▪ /ZDR: closed in neutral position (type BV 1 R)</li> <li>▪ /ZDR: open in neutral position (type BV 1 S)</li> </ul>	
/ZDS	<p>Not in conjunction with ancillary block types / (UNF) (2) 2 AS...BS..., /2 AS...R BS...R, / (UNF) (2) 2 AN...BN..., / (UNF) 2 22 AN..., / (UNF) 2 22 BN..., / (UNF) 2 AL-0-...-BL-0-..., / (UNF) 2 ALX-0-...-BLX-0-..., / (UNF) 2 AL-0-..., / (UNF) 2 ALX-0-..., / (UNF) 2 BL-0-..., / (UNF) 2 BLX-0-...</p>	
/ZDRH	<p>Releasable check valves in A and B. (Type DRH 2 as per <a href="#">D 6110</a>)</p> <p><b>Pressure required for releasing:</b></p> <ul style="list-style-type: none"> <li>▪ 0.4-fold of checked pressure + 3 bar</li> </ul>	

**Coding**

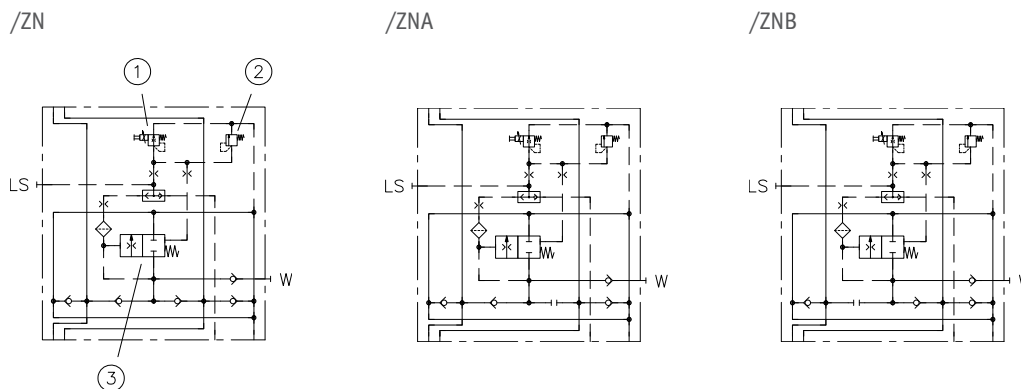
**Description**

**Circuit symbol**

/ZN..  
/ZNX..

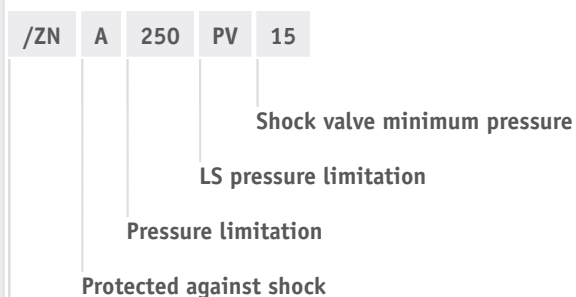
Shock and anti-cavitation valves with electrically adjustable pressure limitation.

The opening pressure of the shock valve can be configured using the electric LS pressure limitation. It opens upon the selected shock valve minimum pressure and configured LS pressure limitation (EM 21 D...).



- 1 LS pressure limitation
- 2 Pressure limitation
- 3 Shock valve

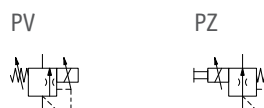
**Ordering example:**



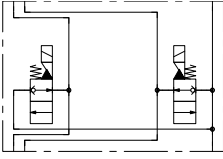
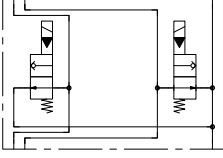
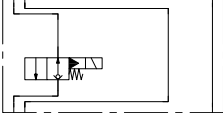
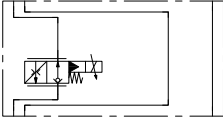
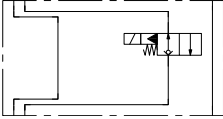
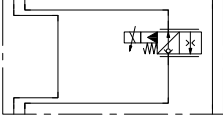
**LS signal hole**

- LS signal hole to the valve
  - : open
  - X: sealed
- Protection against shock
  - : Shock protection in A and B
  - A: Shock protection in A
  - B: Shock protection in B
- LS pressure limitation
  - max. 400 bar
  - fixed

- LS pressure limitation
  - PV:** closed when unpowered (EM 21 DE)
  - PZ:** open when unpowered (EM 21 DSE)






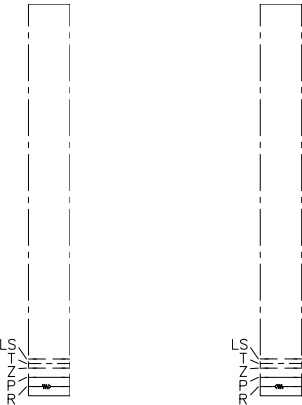

- Shock valve minimum pressure
  - 10, 15, 20, 25 or 30 bar:** fixed

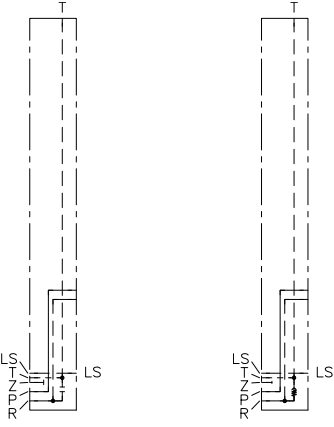
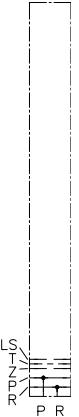
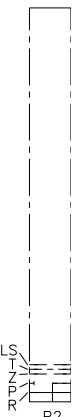
Coding	Description	Circuit symbol
/ZVV	<p>Electrically actuated 2/2-way directional seated valve as check valve from A to R or B to R. (EM 21 V and EM 21 S to <a href="#">D 7490/1</a>).</p> <ul style="list-style-type: none"> <li>▪ /ZVV: Check valve A → R and B → R closed in neutral position</li> <li>▪ /ZSS: Check valve A → R and B → R open in neutral position</li> </ul>	
/ZSS		
/ZVX	<p>Electrically actuated 2/2-way directional seated valve closed in neutral position as check valve in A or B (EM 22 V or EMP 22 V20 as per <a href="#">D 7490/1</a>).</p> <ul style="list-style-type: none"> <li>▪ /ZVX: Check valves in A and B</li> </ul>	
/ZVPX	<ul style="list-style-type: none"> <li>▪ /ZVPX: check valve in A that switches proportionally</li> <li>▪ /ZXV: Check valve in B</li> <li>▪ /ZXPX: check valve in B that switches proportionally</li> </ul>	
/ZXV		
/ZXVP		

## 2.4 Series intermediate plate

**Table 27 Intermediate plate**

Coding	Description
<p>ZPL 22/7 ZPL 22/15 ZPL 22</p>	<p>Spacer plate.</p> <ul style="list-style-type: none"> <li>▪ ZPL 22/7: 7 mm</li> <li>▪ ZPL 22/15: 15 mm</li> <li>▪ ZPL 22: 39.3 mm</li> </ul> 
<p>ZPL 22/7 EX</p>	<p>Spacer plate, 7 mm.</p> <p>If used with solenoid <a href="#">"Table 30"</a></p> <ul style="list-style-type: none"> <li>▪ G.. M2FP..</li> <li>▪ G.. TEX455FM</li> </ul> <p>this intermediate plate has to be applied upstream and downstream of the valve section for mechanical protection purposes.</p> 

Coding	Description
ZPL 22/7/XRT	<p>Locks the R channel and the T channel.</p> 
<p>ZPL 22/15/R1 ZPL 22/15/R2</p>	<p>Check valve in R channel. Q<sub>max</sub> in R: 20 lpm</p> <ul style="list-style-type: none"> <li>▪ <b>ZPL 22/15/R1:</b> Locking direction from connection block toward end plate</li> <li>▪ <b>ZPL 22/15/R2:</b> Locking direction from end plate toward connection block</li> </ul> <p>ZPL 22/15/R1                      ZPL 22/15/R2</p> 
ZPL 22/15/XR	<p>Locks the R channel</p> 

Coding	Description
<p>ZPL 2-SWS2 ZPL 2-SWS2/RB</p>	<p>Transition plate to SWS as per <a href="#">D 7951</a>.</p> <p>ZPL 2-SWS2                      ZPL 2-SWS2/RB</p> 
<p>ZPL 2 P3R3</p>	<p>Additional P and R ports. Ports P and R: G 1/2 (ISO 228-1)</p> 
<p>ZPL 2-Z2</p>	<p>P channel interruption and P port for additional pump circuit. G 3/8 (ISO 228-1)</p> 

**Coding**

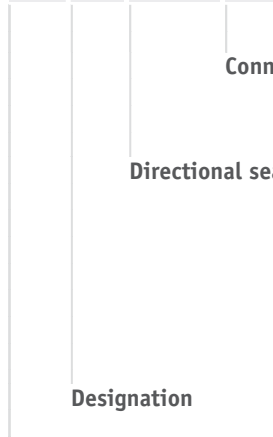
**Description**

A1 RR.../.../...

Intermediate plate with 2/2-way directional seated valves (type EM 31... / EMP 31... as per [D 7490/1](#)) for lifting and lowering single acting cylinders.

**Ordering example:**

A1 RR PV/PV /3



Connecting thread of ancillary block

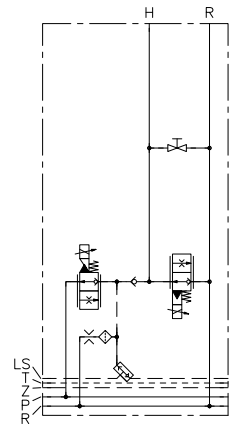
- /3: G 1/2
- /4: G 3/4

Directional seated valve (lifting/lowering)

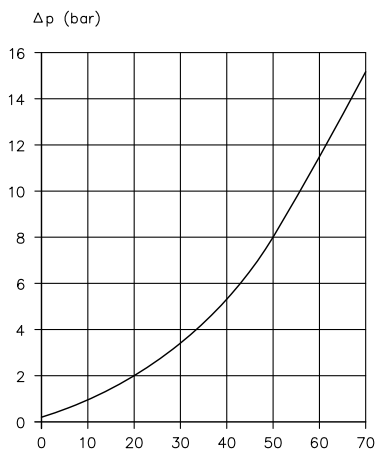
- /V: EM 31 V
- /S: EM 31 S
- /PV: EMP 31 V
- /PV70: EMP 31 V70
- /PV80: EMP 31 V80

**A interface for ancillary block  
1- without 2-way controller**

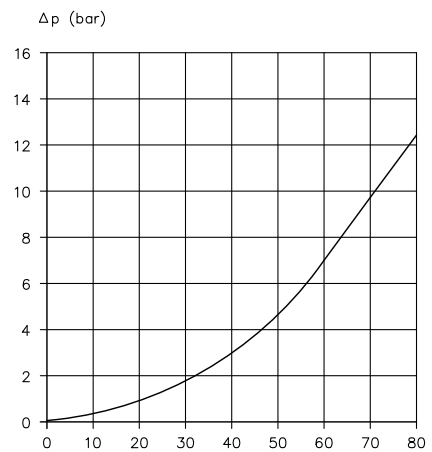
A1 RR PVPV/3



$\Delta p$  P  $\rightarrow$  H (lifting)



$\Delta p$  H  $\rightarrow$  P (lowering)



Cannot be combined with ancillary blocks as per ["Table 25"](#).

**NOTE**

If a valve section with manual operation A is to be installed downstream of this ZPL, a -ZPL 22/7 must be installed so that there are no collisions.



**Coding****Description****ZPL LS/...**LS limitation for downstream spool valve sections.  
Additional LS port: G 1/4 ( ISO 228-1)

## 2.5 End plate

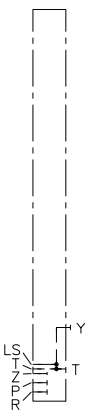
**Table 28 End plate**

Coding	Description
E 1, E 1 UNF E 17, E 17 UNF	T port for external recirculation of control oil to tank. <ul style="list-style-type: none"> <li>▪ <b>E 17:</b> with additional P and R port</li> </ul>
E 2, E 2 UNF E 18, E 18 UNF	With additional Y port for connecting a downstream manifold's LS signal. T port for external recirculation of control oil to tank. <ul style="list-style-type: none"> <li>▪ <b>E 18:</b> with additional P and R port</li> </ul>
E 4, E 4 UNF E 19, E 19 UNF	T channel internally linked with R channel for internal recirculation of control oil through R line. <ul style="list-style-type: none"> <li>▪ <b>E 19:</b> with additional P and R port</li> </ul>
E 5, E 5 UNF E 20, E 20 UNF	With additional Y port for connecting a downstream manifold's LS signal. T channel internally linked with R channel for internal recirculation of control oil through R line. <ul style="list-style-type: none"> <li>▪ <b>E 20:</b> with additional P and R port</li> </ul>
E 3 E 6	With integrated 3/2 directional valve (WN 1 H as per <a href="#">D 7470 A/1</a> ) to switch P to LS when required and shut off the PSL connection block's unpressurised circulation. <ul style="list-style-type: none"> <li>▪ <b>E 3:</b> T port for external recirculation of control oil to tank</li> <li>▪ <b>E 6:</b> T channel internally linked with R channel for internal recirculation of control oil through R line</li> </ul>

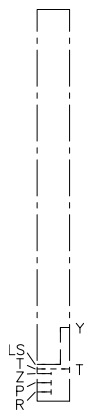
**NOTE**

Internal control oil recirculation through R line is permissible only for return pressures < 10 bar.

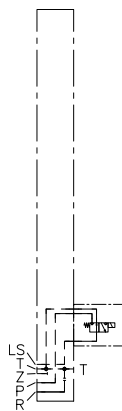
**E 1 (UNF)**



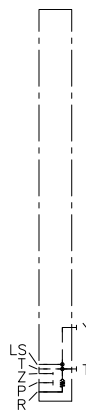
**E 2 (UNF)**



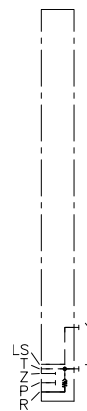
**E 3**

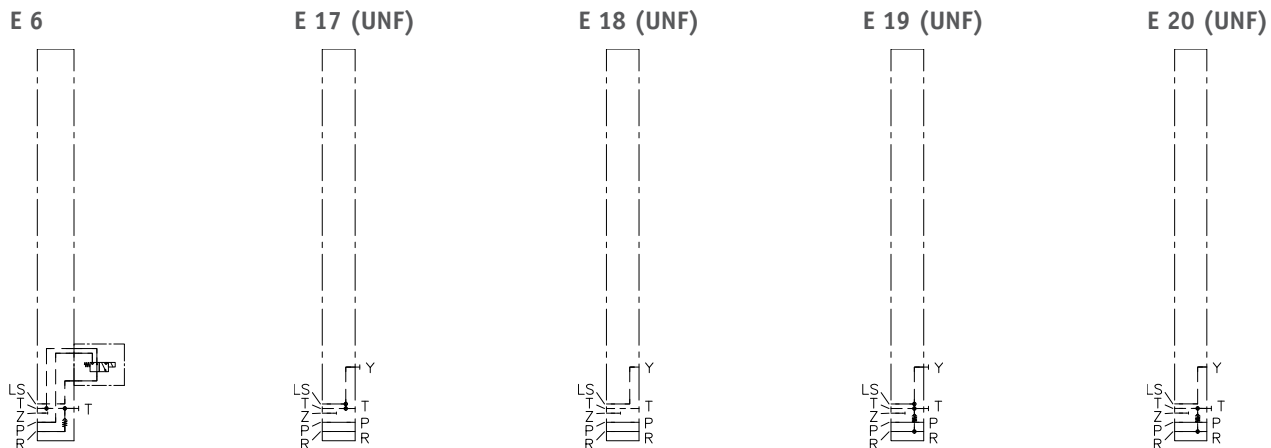


**E 4 (UNF)**



**E 5 (UNF)**





**Coding**

**E 4 PMZ1-...-...**

**Description**

Like E 4 but with a mounted proportional pressure reducing valve (type PMZ 1 as per [D 7625](#)) up to approx 30 bar.

Typical application is for supply to a brake.

**Ordering example:**

E 4 PMZ1	- 30	- AM K 4P 24
----------	------	--------------

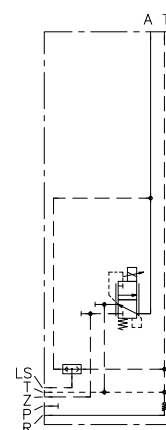
Solenoid version and solenoid voltage

Coding PM - round insert assembly

(Type PM 1 as per [D 7625](#))

**Designation**

**Circuit symbol:**



**Coding**

**Description**

E 19 UNF-...-ADM 22 P...-...

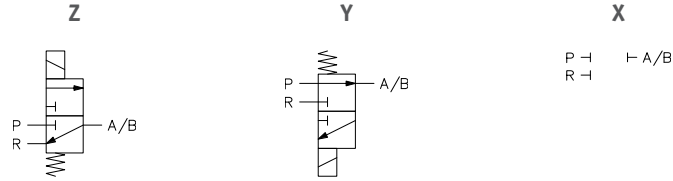
T channel internally linked with R channel for internal recirculation of control oil through R line. With additional P and R port.

The mounted pressure reducing valve ADM 22 P as per [D 7120](#) is upstream of two optional valves type NBVP 16 as per [D 7765 N](#).

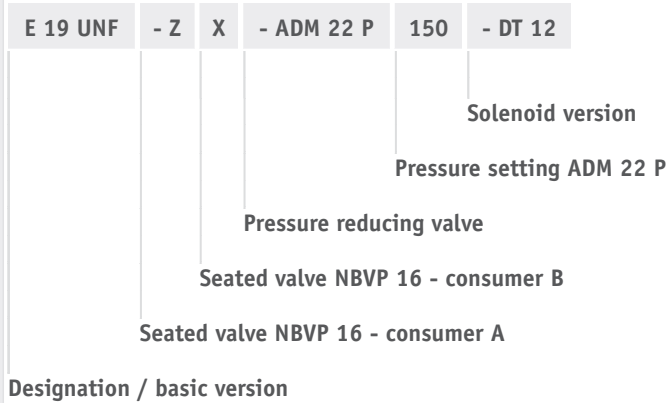
This means the pressure can be set for consumers A and B.

- $p_{max}$  A, B: 250 bar
- $Q_{max}$  A, B: 20 lpm

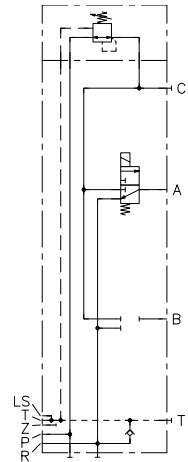
**Combination:**



**Ordering example:**



**Circuit symbol:**



## 2.6 Solenoid versions

Table 29 Standard solenoid versions

Coding	Electrical connection	Nominal voltage	Protection class (IEC 60529)	Valve section with electro-hydraulic actuation (EI, EA, EH, EHA etc.)	Can be combined with certain additional valves			
					WN	BVE	EM, EMP	FP, FPH
AMP 12 K 4 AMP 24 K 4	AMP Junior Timer	12 V DC 24 V DC	IP 67	4-pin, connector position front		●	●	●
AMP 12 K AMP 24 K		12 V DC 24 V DC		3-pin, connector position front		●	●	●
DT 12 DT 24	German (DT 04-4P)	12 V DC 24 V DC	IP 69k	4-pin, connector position side (bottom)		●	●	●
DT 12 T DT 24 T		12 V DC 24 V DC		4-pin, connector position side (bottom), with override		●	●	●
DT 12 TH DT 24 TH		12 V DC 24 V DC		4-pin, connector position side (bottom), with override button		●	●	●
S 12 T S 24 T	Bayonet coupling PA6 Schlemmer	12 V DC 24 V DC	IP 67	3-pin, connector position front, with manual override	●	●	●	●
G 12 G 24	DIN EN 175 301-803 A <ul style="list-style-type: none"> <li>▪ <b>G:</b> with male connector (MSD 3-309 as per <a href="#">D 7163</a>)</li> <li>▪ <b>X:</b> without male connector</li> <li>▪ <b>L:</b> with male connector with LED (SVS 296365 as per <a href="#">D 7163</a>)</li> <li>▪ <b>L5K:</b> with male connector with LED and 5-m cable (L5K-VZP as per <a href="#">D 7163 Erg. 78/1</a>)</li> <li>▪ <b>L10K:</b> with male connector with LED and 10-m cable (L10K-VZP as per <a href="#">D 7163 Erg. 78/1</a>)</li> </ul>	12 V DC 24 V DC	IP 65	3-pin, connector position side (bottom)	●	●	●	●
X 12 X 24		12 V DC 24 V DC			●	●	●	●
L 12 L 24		12 V DC 24 V DC			●	●	●	●
L5K 12 L5K 24		12 V DC 24 V DC			●	●	●	●
L10K 12 L10K 24		12 V DC 24 V DC			●	●	●	●
G 12 T G 24 T		12 V DC 24 V DC		3-pin, connector position side (bottom), with override	●	●	●	●
X 12 T X 24 T		12 V DC 24 V DC			●	●	●	●
L 12 T L 24 T		12 V DC 24 V DC			●	●	●	●
L5K 12 T L5K 24 T		12 V DC 24 V DC			●	●	●	●
L10K 12 T L10K 24 T		12 V DC 24 V DC			●	●	●	●

Coding	Electrical connection	Nominal voltage	Protection class (IEC 60529)	Valve section with electro-hydraulic actuation (EI, EA, EH, EHA etc.)	Can be combined with certain additional valves			
					WN	BVE	EM, EMP	FP, FPH
G 12 TH G 24 TH	DIN EN 175 301-803 A	12 V DC 24 V DC	IP 65	3-pin, connector position side (bottom), with override button	●	●	●	●
X 12 TH X 24 TH	<ul style="list-style-type: none"> <li>▪ <b>G:</b> with male connector (MSD 3-309 as per <a href="#">D 7163</a>)</li> <li>▪ <b>X:</b> without male connector</li> </ul>	12 V DC 24 V DC			●	●	●	●
L 12 TH L 24 TH	<ul style="list-style-type: none"> <li>▪ <b>L:</b> with male connector with LED (SVS 296365 as per <a href="#">D 7163</a>)</li> </ul>	12 V DC 24 V DC			●	●	●	●
L5K 12 TH L5K 24 TH	<ul style="list-style-type: none"> <li>▪ <b>L5K:</b> with male connector with LED and 5-m cable (L5K-VZP as per <a href="#">D 7163</a> Erg. 78/1)</li> </ul>	12 V DC 24 V DC			●	●	●	●
L10K 12 TH L10K 24 TH	<ul style="list-style-type: none"> <li>▪ <b>L10K:</b> with male connector with LED and 10-m cable (L10K-VZP as per <a href="#">D 7163</a> Erg. 78/1)</li> </ul>	12 V DC 24 V DC			●	●	●	●
X 12 C X 24 C	DIN EN 175 301-803 C	12 V DC 24 V DC			IP 65	3-pin, connector position front		
X 12 C 4 X 24 C 4		12 V DC 24 V DC	4-pin, connector position front					
DTL 12 DTL 24	MIL-DTL-38999 series III	12 V DC 24 V DC	IP 67	4-pin, connector position side (bottom)			●	
DTL 12 T DTL 24 T		12 V DC 24 V DC		4-pin, connector position side (bottom), with manual override			●	
ITT 12 ITT 24	VG 95234 MIL	12 V DC 24 V DC		4-pin, connector position side (bottom)			●	

#### Electrical connection for additional valves:

- **WN:** see [D 7470 A/1](#)
- **BVE:** see [D 7921](#)
- **EM 21:** see [D 7490/1 E](#)
- **EM 31, EMP 31:** see [D 7490/1](#)
- **SWS:** see [D 7951](#)
- **PM 1, PMZ1:** see [D 7625](#)

Different connector designs (e.g. EA actuation with AMP 24 K 4 and WN valve with G 24) are available upon request.

#### Electrical connection for electro-proportional LS pressure limitation coding FP., FPH..:

Only twin solenoids with manual override (coding -...T or -...TH) are possible.

If a twin solenoid without manual override was chosen for the valve section's electro-hydraulic actuation, the same twin solenoid type is automatically used for the LS pressure limitation's electro-proportional actuation, but with additional manual override.

If the twin solenoid type is not possible with manual override, coding -G...T is used by default.

**Table 30 Solenoid versions for potentially explosive atmospheres**

Coding	Description
G 24 TEX 4 55 FM G 24 TEX 4 55 FM-10 m	Explosion-proof solenoid with cable
G 12 M2FP G 12 M2FP-10 m	<ul style="list-style-type: none"> <li>▪ <b>No additional specification:</b> with 3-m cable</li> <li>▪ <b>10 m:</b> with 10-m cable</li> </ul>
G 24 M2FP G 24 M2FP-10 m	<p>In the case of PSL valve banks, ZPL 22/7 EX are also required as mechanical protection plates. They are inserted downstream of the connection block and upstream of the end plate. A ZPL 52 (<a href="#">D 7700-5</a>) or ZPL 32 (<a href="#">D 7700-3</a>) replaces the protection plate on size combinations.</p> <p>For additional details, see operating instructions <a href="#">B ATEX</a></p>

## 3 Parameters

### 3.1 General and hydraulic

#### General information

<b>Designation</b>	Proportional directional spool valve PSL/PSV/PSM	
<b>Design</b>	Manifold with up to 14 valve sections	
<b>Material</b>	Steel, nitrided surfaces, internal function parts tempered and polished, solenoids' surfaces galvanised	
<b>Attachment</b>	Mounting thread M8, see <a href="#">Chapter 4, "Dimensions"</a>	
<b>Installation position</b>	any	
<b>Ports</b>	<b>P</b>	Pump
	<b>R</b>	Reflux
	<b>A, B</b>	Consumer
	<b>LS, DW, U, W, X, XH, Y</b>	Load pressure signal
	<b>M</b>	Pressure gauge connection for pump pressure
	<b>a, b</b>	Pressure gauge connection for consumer pressure
	<b>Z</b>	Pilot pressure
	<b>T</b>	Tank line for control oil
	<b>Connecting thread:</b>	
	<ul style="list-style-type: none"> <li>▪ <b>P, R, A, B:</b> as per type designation</li> <li>▪ <b>M, LS, DW, Y, Z, T:</b> G 1/4 (ISO 228-1) or SAE-4, or 7/16-20 UNF-2B (SAE J 514)</li> <li>▪ <b>U, W, X, XH:</b> G 1/8 (ISO 228-1)</li> <li>▪ <b>a, b:</b> G 1/4 or G 1/8 (ISO 228-1)</li> </ul>	
<b>Hydraulic fluid</b>	Hydraulic fluid: equivalent to part 1 to 3; ISO VG 10 to 68 as per DIN ISO 3448 Viscosity limits: min. approx. 4, max. approx. 1500 mm <sup>2</sup> /s opt. operation approx. 10... 500 mm <sup>2</sup> /s. Also suitable for biologically degradable hydraulic fluids type HEPG (polyalkylene glycol) and HEES (synthetic ester) at operating temperatures up to approx. +70°C. Not suitable for HETG such as rapeseed oil and water-glycol solutions such as HFA or HFC.	
<b>Cleanliness level</b>	<b>ISO 4406</b> <hr style="width: 50%; margin-left: 0;"/> 20/17/14	



## Temperatures

Environment: approx. -40 ... +80°C, hydraulic fluid: -25 ... +80°C, note viscosity range.  
 Start temperature: down to -40°C is permissible (observe start viscosities!), as long as the steady-state temperature is at least 20K higher during subsequent operation.  
 Biologically degradable hydraulic fluids: note manufacturer specifications. With consideration for the seal compatibility, not above +70°C.

### **i** NOTE

Note restrictions on explosion-proof solenoid.

## Pressure and flow rate

### Operating pressure

- $p_{\max} = 420$  bar (ports P, P1, P2, A, B, LS, M, Y)
- Pilot pressure  $\leq 40$  bar (port Z)
- Return pressure  $\leq 50$  bar (ports R, R1, T) for high return pressures, T port should be routed to the tank separately  
 (see end plate E 1, E 2, E 3 etc. as per ["Table 28"](#))

### Flow rate

- $Q_{\max}$  connection block: see [Chapter 3.2, "Characteristic lines"](#)
- $Q_{\max}$  consumer: see ["Table 15: Flow rate"](#)

## Weight

### Connection block

#### Type

PSV 3	= 1.7 kg
PSV 4	= 2.0 kg
PSL 3	= 1.7 kg
PSL 3 Z	= 2.0 kg

#### For additional functions:

Z... (see <a href="#">"Table 7"</a> )	= 0.6 kg
---------------------------------------	----------

### Directional valve section

#### Valve section with actuation

#### Coding

A, E, E0A	= 1.6 kg
EA	= 1.9 kg
EHA	= 1.8 kg
HA	= 2.2 kg

#### For additional functions:

A..B..FP(H) 1(2, 3), S1	= + 0.4 kg
-------------------------	------------

<b>Ancillary block</b>	<table border="0"> <thead> <tr> <th colspan="2" data-bbox="571 203 647 232"><b>Coding</b></th> </tr> </thead> <tbody> <tr> <td data-bbox="571 248 663 277">/(UNF) 2</td> <td data-bbox="1126 248 1222 277">= 0.25 kg</td> </tr> <tr> <td data-bbox="571 293 791 322">/(UNF) 2 AS.. BS.., /3</td> <td data-bbox="1126 293 1222 322">= 0.3 kg</td> </tr> <tr> <td data-bbox="571 338 759 367">/(UNF) 2 AN.. BN..</td> <td data-bbox="1126 338 1222 367">= 0.4 kg</td> </tr> <tr> <td data-bbox="571 383 810 412">/(UNF) 2 AL-0-.. BL-0-..</td> <td data-bbox="1126 383 1222 412">= 0.6 kg</td> </tr> <tr> <td data-bbox="571 427 836 456">/(UNF) 2 ALX-0-.. BLX-0-..</td> <td data-bbox="1126 427 1222 456">= 0.6 kg</td> </tr> <tr> <td data-bbox="571 472 788 501">/(UNF) 2 DRH, /ZDRH</td> <td data-bbox="1126 472 1222 501">= 0.3 kg</td> </tr> <tr> <td data-bbox="571 517 836 546">/ZSS, /ZVV, /3 AVT, /3 BVT</td> <td data-bbox="1126 517 1222 546">= 1.0 kg</td> </tr> <tr> <td data-bbox="571 562 804 591">/ZDR, /ZDS, /Z 2 A(B)..</td> <td data-bbox="1126 562 1222 591">= 1.0 kg</td> </tr> <tr> <td data-bbox="571 607 746 636">/32 DFA, /32 DFB</td> <td data-bbox="1126 607 1222 636">= 0.6 kg</td> </tr> <tr> <td data-bbox="571 651 632 680">/Z 40</td> <td data-bbox="1126 651 1222 680">= 0.5 kg</td> </tr> <tr> <td data-bbox="571 696 689 725">/Z AL.. BL..</td> <td data-bbox="1126 696 1222 725">= 0.6 kg</td> </tr> </tbody> </table>	<b>Coding</b>		/(UNF) 2	= 0.25 kg	/(UNF) 2 AS.. BS.., /3	= 0.3 kg	/(UNF) 2 AN.. BN..	= 0.4 kg	/(UNF) 2 AL-0-.. BL-0-..	= 0.6 kg	/(UNF) 2 ALX-0-.. BLX-0-..	= 0.6 kg	/(UNF) 2 DRH, /ZDRH	= 0.3 kg	/ZSS, /ZVV, /3 AVT, /3 BVT	= 1.0 kg	/ZDR, /ZDS, /Z 2 A(B)..	= 1.0 kg	/32 DFA, /32 DFB	= 0.6 kg	/Z 40	= 0.5 kg	/Z AL.. BL..	= 0.6 kg
<b>Coding</b>																									
/(UNF) 2	= 0.25 kg																								
/(UNF) 2 AS.. BS.., /3	= 0.3 kg																								
/(UNF) 2 AN.. BN..	= 0.4 kg																								
/(UNF) 2 AL-0-.. BL-0-..	= 0.6 kg																								
/(UNF) 2 ALX-0-.. BLX-0-..	= 0.6 kg																								
/(UNF) 2 DRH, /ZDRH	= 0.3 kg																								
/ZSS, /ZVV, /3 AVT, /3 BVT	= 1.0 kg																								
/ZDR, /ZDS, /Z 2 A(B)..	= 1.0 kg																								
/32 DFA, /32 DFB	= 0.6 kg																								
/Z 40	= 0.5 kg																								
/Z AL.. BL..	= 0.6 kg																								
<b>End plates</b>	<table border="0"> <thead> <tr> <th colspan="2" data-bbox="571 790 647 819"><b>Coding</b></th> </tr> </thead> <tbody> <tr> <td data-bbox="571 835 967 864">E 1(UNF), E 2(UNF), E 4(UNF), E 5(UNF)</td> <td data-bbox="1126 835 1222 864">= 0.5 kg</td> </tr> <tr> <td data-bbox="571 880 647 909">E 3, E 6</td> <td data-bbox="1126 880 1222 909">= 1.1 kg</td> </tr> <tr> <td data-bbox="571 925 1015 954">E 17(UNF), E 18(UNF), E 19(UNF), E 20(UNF)</td> <td data-bbox="1126 925 1222 954">= 1.0 kg</td> </tr> </tbody> </table>	<b>Coding</b>		E 1(UNF), E 2(UNF), E 4(UNF), E 5(UNF)	= 0.5 kg	E 3, E 6	= 1.1 kg	E 17(UNF), E 18(UNF), E 19(UNF), E 20(UNF)	= 1.0 kg																
<b>Coding</b>																									
E 1(UNF), E 2(UNF), E 4(UNF), E 5(UNF)	= 0.5 kg																								
E 3, E 6	= 1.1 kg																								
E 17(UNF), E 18(UNF), E 19(UNF), E 20(UNF)	= 1.0 kg																								

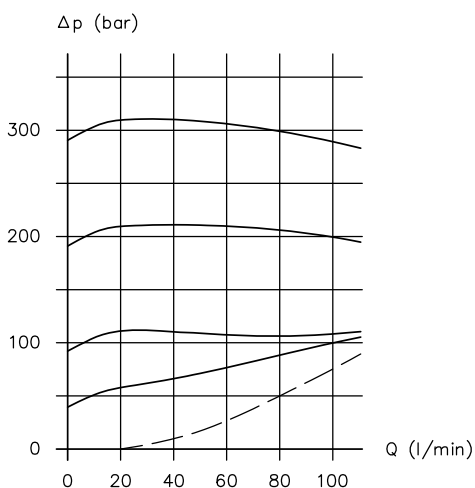
### 3.2 Characteristic lines

Oil viscosity approx. 60 mm<sup>2</sup>/s

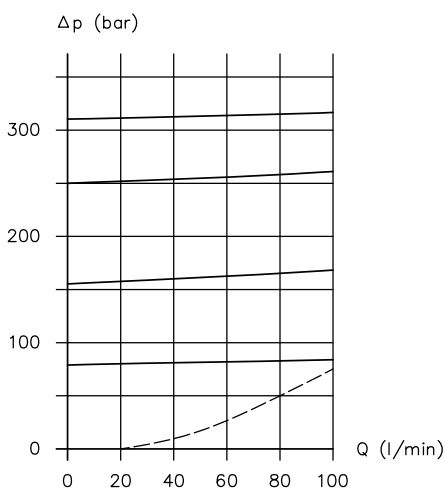
#### Connection block

##### Pressure-limiting valve (P → R)

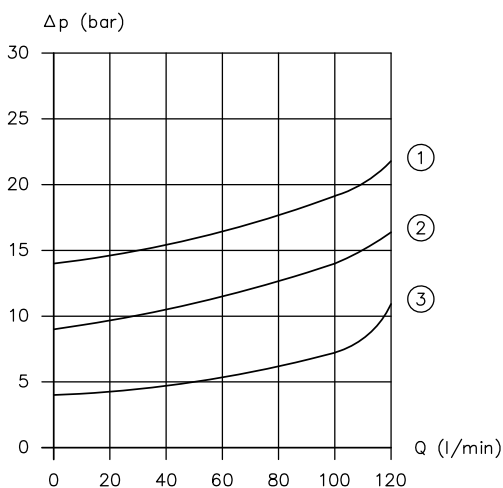
PSL 3../D...-2  
PSL UNF 2../D...-2  
PSV 3../D...-2  
PSV UNF 2../D...-2  
PSV 4 N...



PSL 3 U.../...-2  
PSL UNF 2 U.../...-2



##### Circulation pressure (P → R) in PSL connection blocks

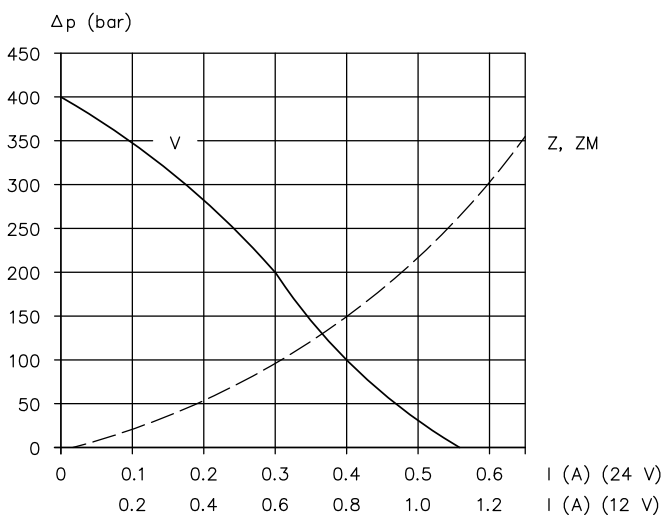


- 1 PSL 3H/..., PSL UNF 2H...
- 2 PSL 3..., PSL UNF 2...
- 3 PSL 3U/..., PSL UNF 2U...

##### Circulation pressure

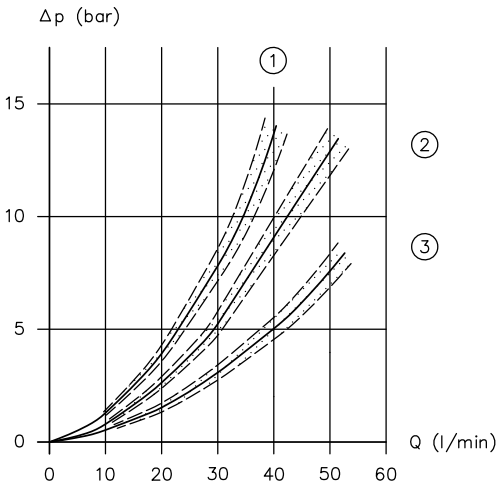
(electro-proportional LS pressure limitation as per "Table 7")

##### Coding V, Z, ZM



**Directional valve section**

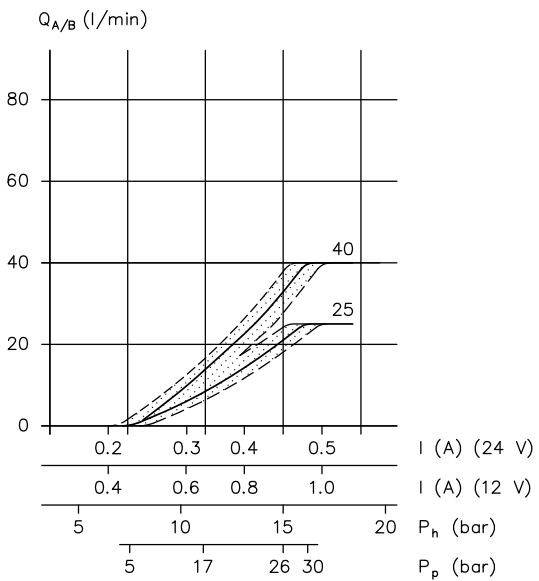
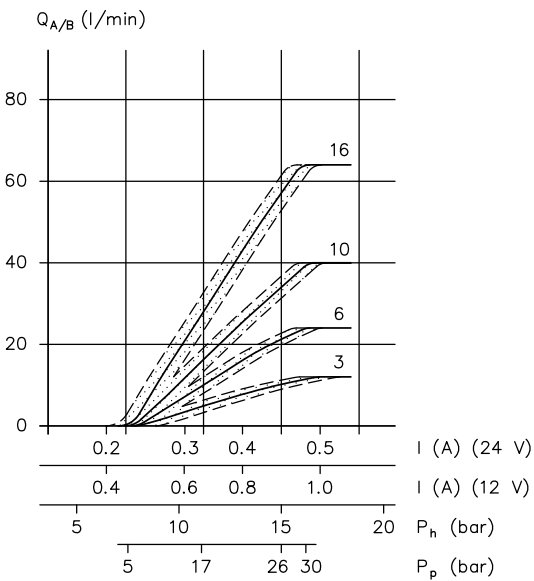
**Pressure difference  $P \rightarrow A/B$  and  $A/B \rightarrow R$**



- 1  $P \rightarrow A/B$  for valve section with 2-way controller  
(see ["Table 11: Valve section"](#), without coding)
- 2  $P \rightarrow A/B$  for valve section without 2-way controller  
(see ["Table 11: Valve section"](#), coding 1)
- 3  $A/B \rightarrow R$  in spool valve coding L, M, F, H  
(see ["Table 14: Circuit symbol"](#))

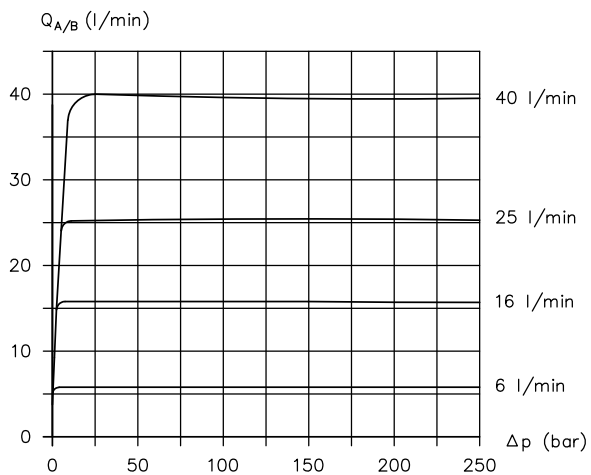
**Control characteristic line consumer/flow rate as per ["Table 15"](#)**

(reference values measured with 2-way controller and standard 2-way controller spring)

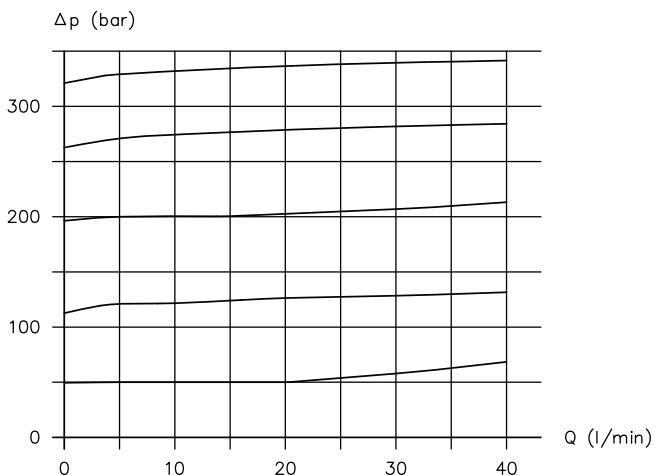


$p_h$  = pilot pressure for hydraulic actuation  
 $p_p$  = pilot pressure for pneumatic actuation  
 Switching angle ( $^\circ$ ) for manual actuation with hand lever

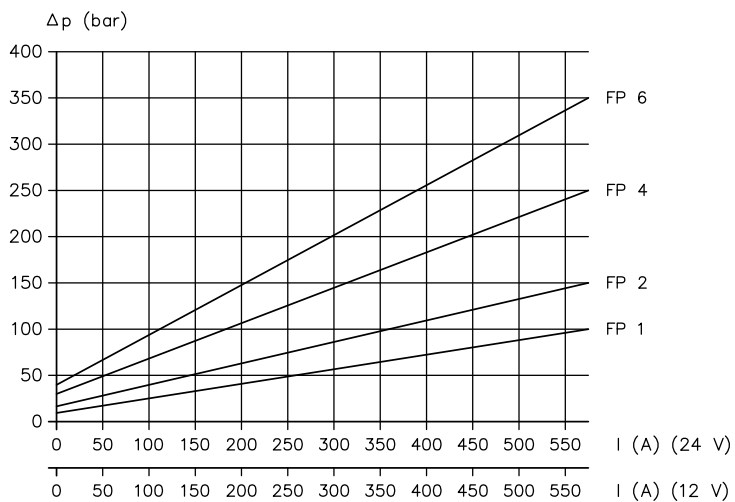
2-way controller as per ["Table 11"](#)



LS pressure limiting valves as per ["Table 16"](#)



Electro-proportional LS pressure limitation as per ["Table 17"](#)



### 3.3 Electrical parameters

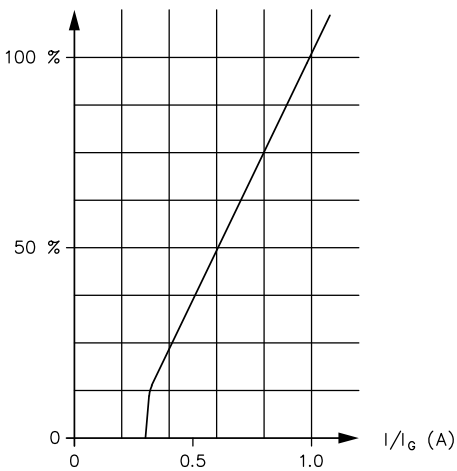
#### 3.3.1 Electro-hydraulic actuation with standard solenoid

Electric version and certification as per DIN VDE 0580

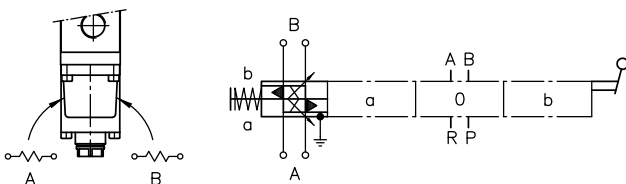
Twin solenoid with anchor chambers sealed on the outside and connected to the tank channel. The anchors in the anchor chambers are thereby lubricated by the hydraulic oil and protected against corrosion without the need for maintenance.

Nominal voltage $U_N$	12 V DC	24 V DC
Resistance $R_{20}$	6.7 $\Omega$	28.0 $\Omega$
Current, cold $I_{20}$	1.8 A	0.86 A
Limit current $I_G$	1.16 A	0.58 A
Limit power $P_G$	13.9 W	13.9 W
Duty cycle	S1 (100%)	
Dither frequency	40 to 70 Hz (recommended value: 55 Hz)	
Dither amplitude $A_D(\%) = \frac{I_{Spitze-Spitze}}{I_G} \cdot 100$	$20\% \leq A_D \leq 50\%$	

#### I stroke characteristic curves



#### Ports



Specifications for **A** and **B**

see Table "Electrical connection", "Connection" column

**Electrical connection**

Coding	Specification	Connection	Plug
AMP 12 (24) K	AMP Junior Timer 3-pin IP 67 (IEC 60529)		
AMP 12 (24) K 4	AMP Junior Timer 4-pin IP 67 (IEC 60529)		
DT 12 (24) DT 12 (24) T	German (DT04 - 4p) 4-pin IP 69k (IEC 60529)		
S 12 (24) S 12 (24) T	Bayonet coupling PA6 Schlemmer 3-pin IP 67 (IEC 60529)		
X 12 (24) G 12 (24) L 12 (24) X 12 (24) T G 12 (24) T L 12 (24) T X 12 (24) TH G 12 (24) TH L 12 (24) TH	DIN EN 175 301-803 A 3-pin IP 65 (IEC 60529)		
X 12 (24) C G 12 (24) C	DIN EN 175 301-803 C 3-pin IP 65 (IEC 60529)		
X 12 (24) C4 G 12 (24) C4	DIN EN 175 301-803 C 3-pin IP 65 (IEC 60529)		
ITT 12 (24)	VG95234 MIL 4-pin IP 67 (IEC 60529)		
DTL 12 (24) DTL 12 (24) T	MIL-DTL 38999 series III 4-pin IP 67 (IEC 60529)		

### 3.3.2 Electro-hydraulic actuation with solenoid for potentially explosive atmospheres

**i NOTE**

When using solenoids for potentially explosive atmospheres, it is essential to observe the operating instructions [B ATEX](#) and the separate operating instructions for the respective solenoid.

Refer to the applicable operating instructions for operating thresholds, classifications, electrical parameters and electrical connections.

Coding	Operating instructions with declaration of conformity
G 24 TEX 4 55 FM G 24 TEX 4 55 FM-10 m	<ul style="list-style-type: none"> <li>▪ B ATEX</li> <li>▪ B 28/2012 (EX04)</li> </ul>
G 24 M2FP G 24 M2FP-10 m	<ul style="list-style-type: none"> <li>▪ B ATEX</li> <li>▪ B 25/2012 (EX03)</li> </ul>

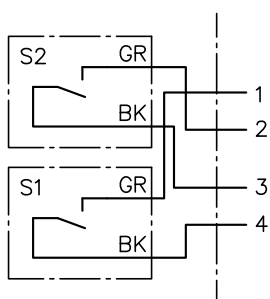


### 3.3.3 Switching position monitoring, displacement transducer

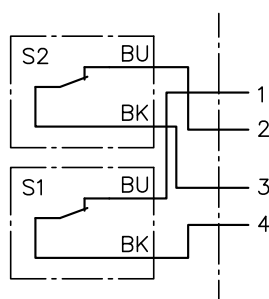
#### Coding VCHO, VCHC, VCHOC

Connector	Hirschmann type G 4 W 1 F (4-pin)
Resistance load at 30 V DC	5 A
Inductive load	3 A
Protection class	IP 65 (IEC 60529)
Labelling	<ul style="list-style-type: none"> <li>▪ VCHO: NO</li> <li>▪ VCHC: NC</li> <li>▪ VCHOC: NOC</li> </ul>

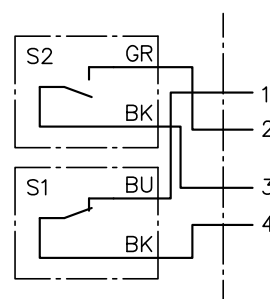
**VCHO**



**VCHC**



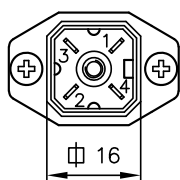
**VCHOC**



Direction detection:

Direction A – contact switch S2

Direction B – contact switch S1



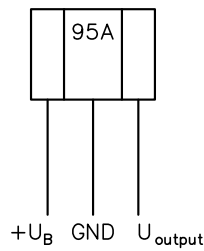
**Coding WA**

Coding	Electrical connection	Protection class (IEC 60529)
WA	DIN EN 175 301-803 A	IP 65
WA-AMP	AMP Junior Timer	IP 67
WA-DT	German (DT 04-4P)	IP 69k
WA-C	DIN EN 175 301-803 C	IP 65

**Pin assignment:**

- 1 =  $U_{output}$
- 2 =  $+U_B$  (5 to 10 V)
- 3 = GND
- Earth = not assigned

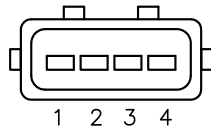
**Sensor assignment:**



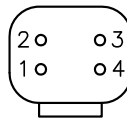
WA



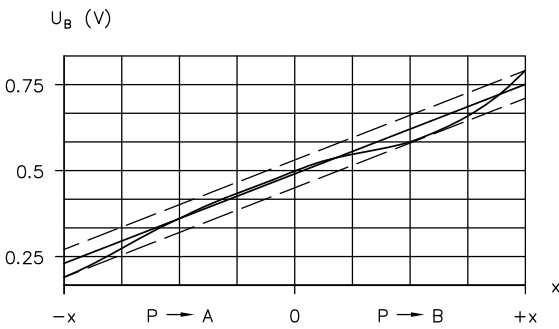
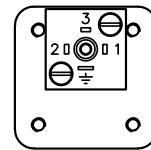
WA-AMP



WA-DT



WA-C



$x$  = spool stroke  
 $U_B$  = signal voltage  
 $U_{B \max} = 76\%$   
 $U_{B \min} = 24\%$   
 Accuracy  $\pm 9\%$  (of  $U_B$ )

Use stabilised, smoothed DC voltage only.



**NOTE**

The displacement transducer will be destroyed by strong magnetic fields.

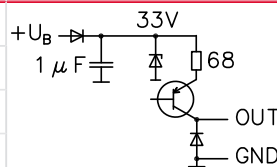
## Coding U

Protection class

IP 65 (IEC 60529)

### Pin assignment

Pin	Signal	Description
1	OUTA	PNP positive-switching
2	OUTB	PNP positive-switching
3	+U <sub>B</sub>	10 ... 32 V DC
⊖	GND	0 V DC

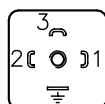


Open-Collector:  
 $I_{\max} = 10 \text{ mA}$   
 short-circuit-proof

### Status table

Running no.	Spool valve action	Signal outputs PNP transistor with open collector:	
		OUTA	OUTB
1	Neutral position in centre	ON	ON
2	P → B	OFF	ON
3	P → A	ON	OFF

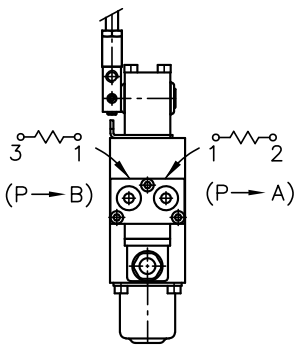
### U



### 3.3.4 Electric LS relief or LS pressure limitation

Electric LS relief coding FP., FPH..

Nominal voltage $U_N$	12 V DC	24 V DC
Resistance $R_{20}$	6.7 $\Omega$	28.0 $\Omega$
Current, cold $I_{20}$	1.8 A	0.86 A
Limit current $I_G$	1.16 A	0.58 A
Limit power $P_G$	13.9 W	13.9 W
Duty cycle	S1 (100%)	
Dither frequency	40 to 70 Hz (recommended value: 55 Hz)	
Dither amplitude	$20\% \leq A_D \leq 50\%$	
$A_D(\%) = \frac{I_{Spitze-Spitze}}{I_G} \cdot 100$		



#### Electrical connection

Coding	Specification	Connection	Plug
DT 12 (24) T	German (DT04 - 4p) 4-pin IP 69k (IEC 60529)		
S 12 (24) T	Bayonet coupling PA6 Schlemmer 3-pin IP 67 (IEC 60529)		
X 12 (24) T G 12 (24) T L 12 (24) T X 12 (24) TH G 12 (24) TH L 12 (24) TH	DIN EN 175 301-803 A 3-pin IP 65 (IEC 60529)		
DTL 12 (24) T	MIL-DTL 38999 series III 4-pin IP 67 (IEC 60529)		

**i NOTE**  
Duty cycle applies separately for a single twin solenoid coil. If both coils are powered simultaneously, only half that time is permitted duty cycle.

**i NOTE**

- Only twin solenoids with manual override (coding -...T or -...TH) are possible.
- If a twin solenoid without manual override was chosen for the valve section's electro-hydraulic actuation, the same twin solenoid type is automatically used for the LS pressure limitation's electro-proportional actuation, but with additional manual override.
- If the twin solenoid type is not possible with manual override, coding -G...T is used by default.

### 3.3.5 Electric LS relief or LS pressure limitation for potentially explosive atmospheres

**! NOTE**

When using solenoids for potentially explosive atmospheres, it is essential to observe the operating instructions [B ATEX](#) and the separate operating instructions for the respective solenoid.  
Refer to the applicable operating instructions for operating thresholds, classifications, electrical parameters and electrical connections.

Coding	Operating instructions with declaration of conformity
G 24 TEX 4 55 FM G 24 TEX 4 55 FM-10 m	<ul style="list-style-type: none"> <li>▪ B ATEX</li> <li>▪ B 28/2012 (EX04)</li> </ul>
G 24 M2FP G 24 M2FP-10 m	<ul style="list-style-type: none"> <li>▪ B ATEX</li> <li>▪ B 25/2012 (EX03)</li> </ul>

### 3.3.6 Additional valves

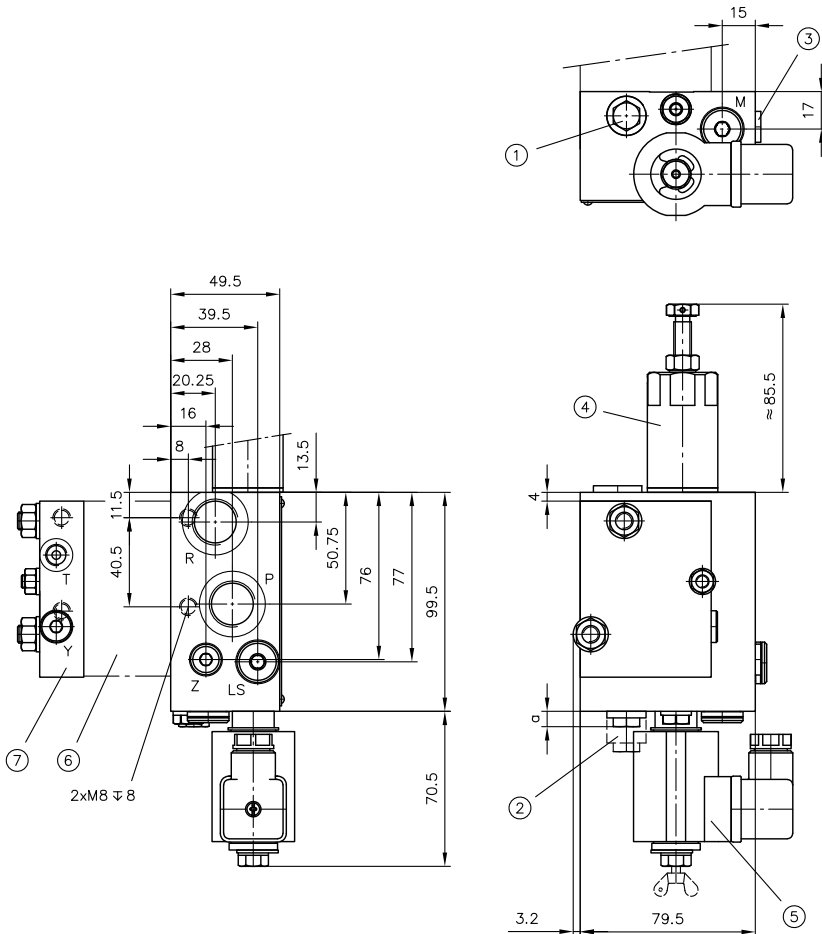
The types of plugs available are described in [Chapter 2.6, "Solenoid versions"](#). Refer to the respective additional valve's data sheet for electrical parameters.

## 4 Dimensions

All dimensions in mm, subject to change.

### 4.1 Connection block

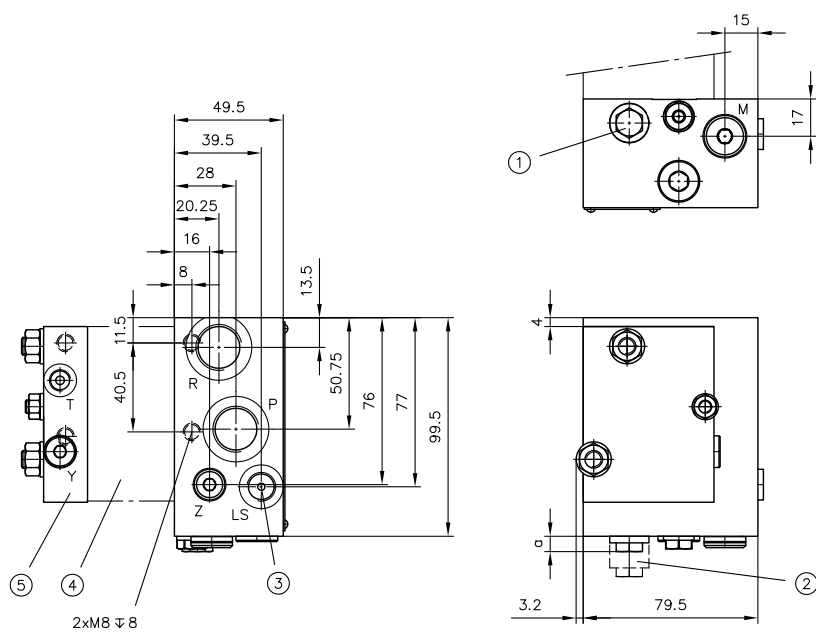
PSL 3.../D...-2, PSV 3.../D...-2  
PSL UNF 2.../D...-2, PSV UNF 2.../D...-2



- 1 Internal control oil supply coding 1 or without designation
- 2 Internal control oil supply coding 2
- 3 LS damping
- 4 Pressure-limiting valve
- 5 optional ZM
- 6 Valve section
- 7 End plate

Coding	a	Type	Ports as per ISO 228-1 or SAE J 514		
			P, R	LS, M	Z
Without coding	6.5	PSL 3.../D...-2 PSV 3.../D...-2	G 1/2	G 1/4	G 1/8
1	6.5	PSL UNF 2.../D...-2 PSV UNF 2.../D...-2	3/4-16 UNF-2B	7/16-20 UNF-2B	7/16-20 UNF-2B
2	18.4				

PSV 3...-2  
PSV UNF 2...-2

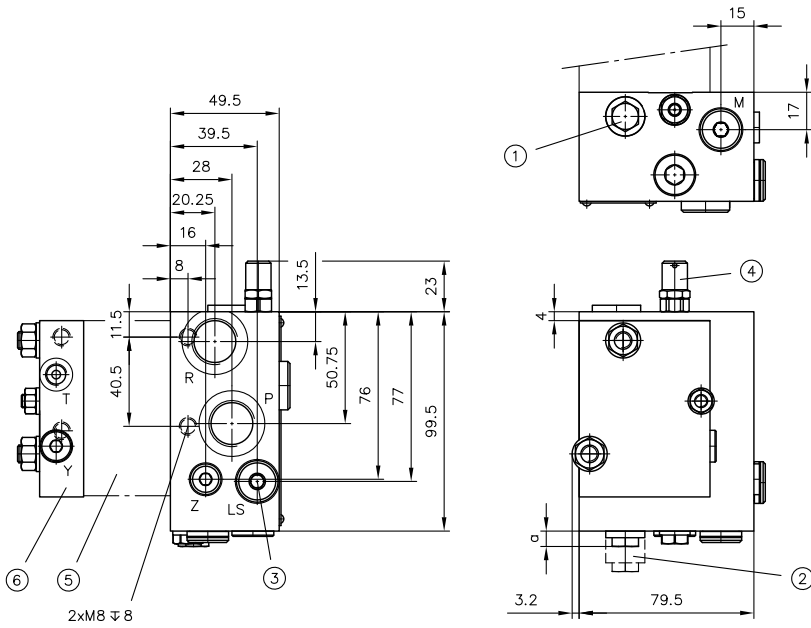


- 1 Internal control oil supply coding 1 or without designation
- 2 Internal control oil supply coding 2
- 3 LS damping
- 4 Valve section
- 5 End plate

Coding	a
Without coding	6.5
1	6.5
2	18.4

Type	Ports as per ISO 228-1 or SAE J 514		
	P, R	LS, M	Z
PSV 3...-2	G 1/2	G 1/4	G 1/8
PSV UNF 2...-2	3/4-16 UNF-2B	7/16-20 UNF-2B	7/16-20 UNF-2B

PSL 3U.../...-2  
PSL UNF 2U.../...-2



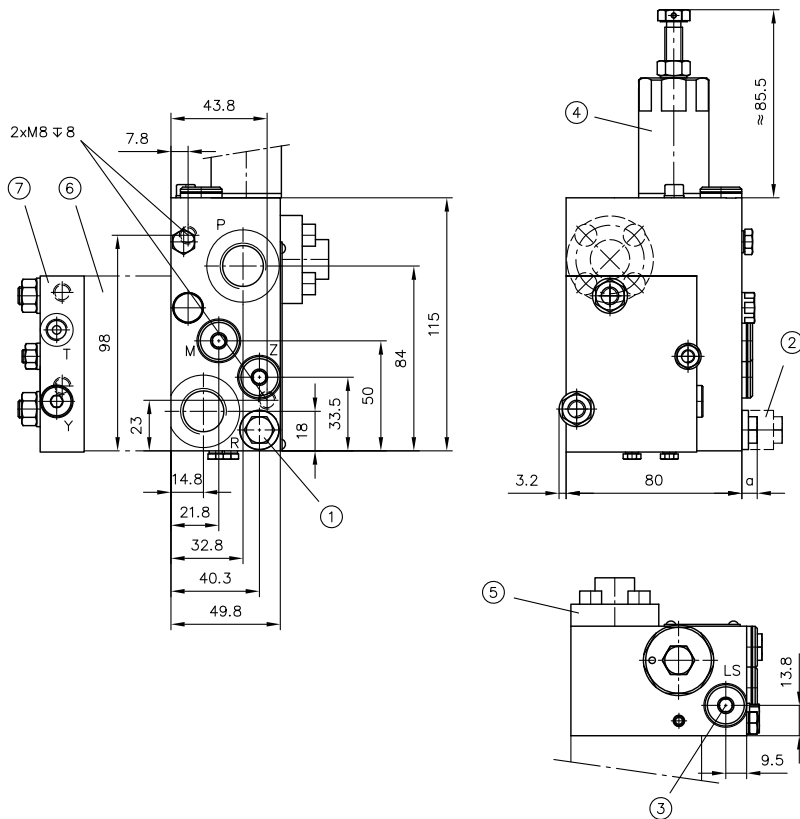
- 1 Internal control oil supply coding 1 or without designation
- 2 Internal control oil supply coding 2
- 3 LS damping
- 4 Pressure-limiting valve
- 5 Valve section
- 6 End plate

Coding	a
Without coding	6.5
1	6.5
2	18.4

Type	Ports as per ISO 228-1 or SAE J 514		
	P, R	LS, M	Z
PSL 3U.../...-2	G 1/2	G 1/4	G 1/8
PSL UNF 2U.../...-2	3/4-16 UNF-2B	7/16-20 UNF-2B	7/16-20 UNF-2B



PSL 3 Z.../D...-2



- 1 Internal control oil supply coding 1 or without designation
- 2 Internal control oil supply coding 2
- 3 LS damping
- 4 Pressure-limiting valve
- 5 3-way controller's spring housing
- 6 Valve section
- 7 End plate

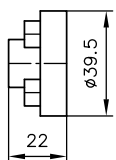
Coding	a
Without coding	6.5
1	6.5
2	18.4

Type	Ports as per ISO 228-1	
	P, R	LS, M, Z
PSL 3 Z.../D...-2	G 1/2	G 1/4

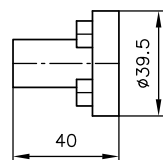
**3-way controller's spring housing**

**3-way controller's spring housing with locking tapped plug**

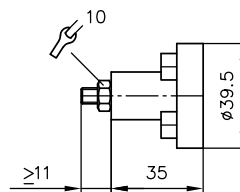
No designation



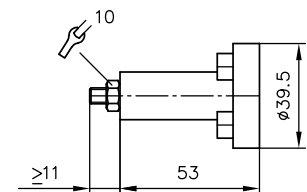
Coding H



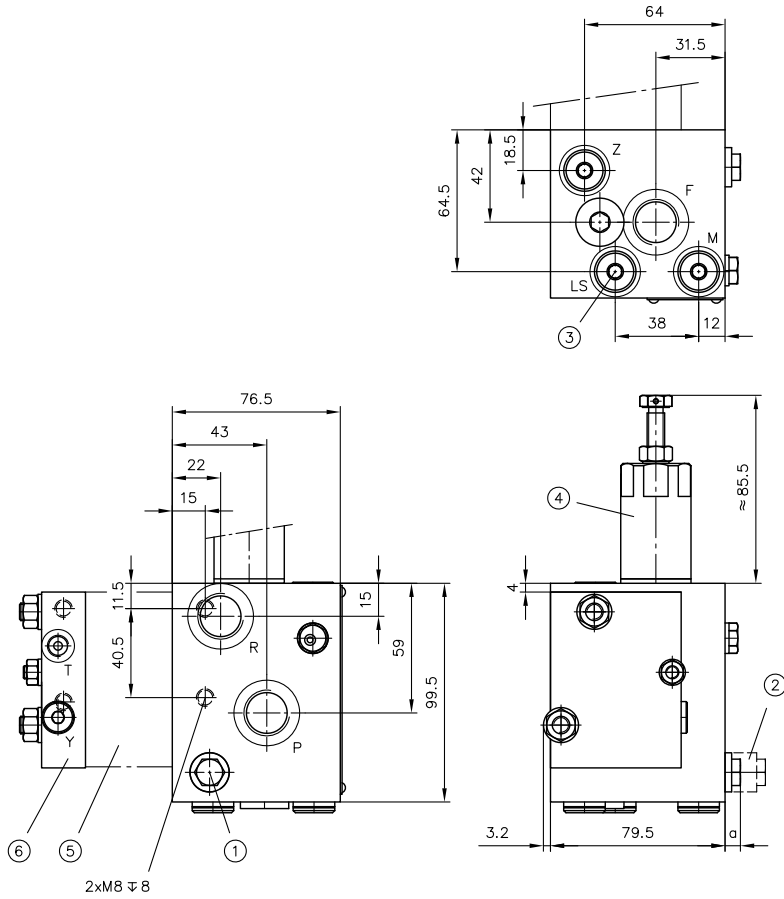
Coding T



Coding HT



PSL 3Y.../...-2

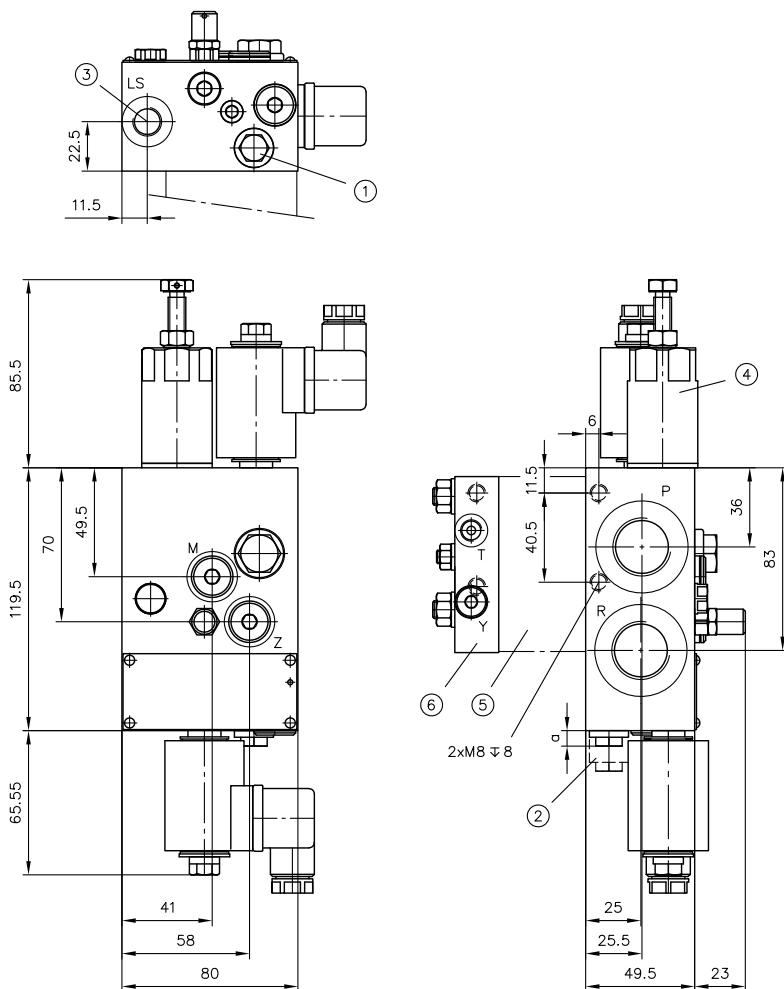


- 1 Internal control oil supply coding 1 or without designation
- 2 Internal control oil supply coding 2
- 3 LS damping
- 4 Pressure-limiting valve
- 5 Valve section
- 6 End plate

Coding	a
Without coding	6.5
1	6.5
2	18.4

Type	Ports as per ISO 228-1	
	P, R, F	LS, M
PSL 3Y.../...-2	G 1/2	G 1/4

PSV 4N.../.../...-2  
PSV UNF 4N.../.../...-2

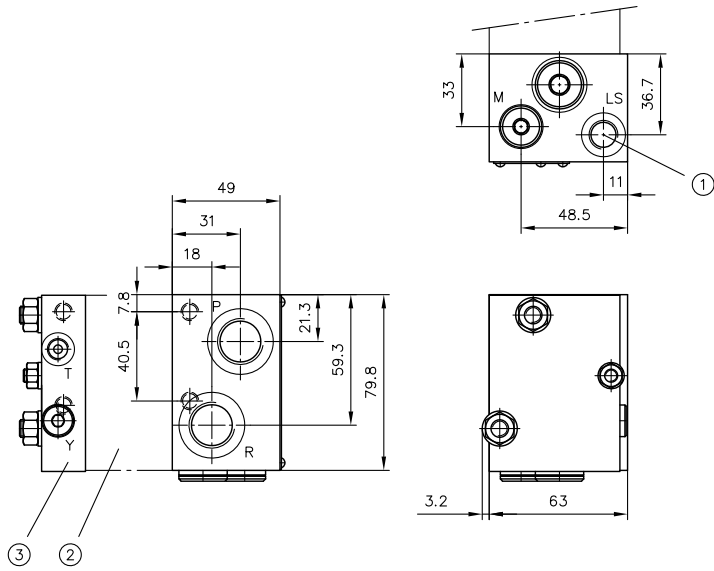


- 1 Internal control oil supply coding 1 or without designation
- 2 Internal control oil supply coding 2
- 3 LS damping
- 4 Pressure-limiting valve
- 5 Valve section
- 6 End plate

Coding	a
Without coding	6.5
1	6.5
2	18.4

Type	Ports as per ISO 228-1 or SAE J 514		
	P, R	LS, M	Z
PSV 4N.../.../...-2	G 3/4	G 1/4	G 1/8
PSV UNF 4N.../.../...-2	11/16-12 UNF-2B	7/16-20 UNF-2B	7/16-20 UNF-2B

PSV 3X...-2



- 1 LS damping
- 2 Valve section
- 3 End plate

Type	Ports as per ISO 228-1	
	P, R	LS, M
PSV 3X...-2	G 1/2	G 1/4

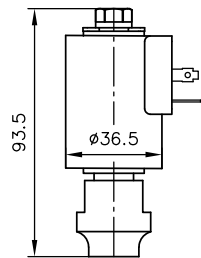
**Additional valves for LS relief or LS pressure limitation on connection block**

as per ["Table 7: LS relief or LS pressure limitation"](#)

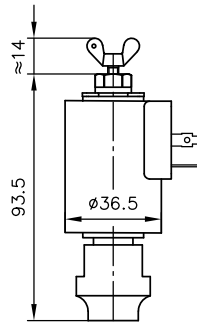
Without coding



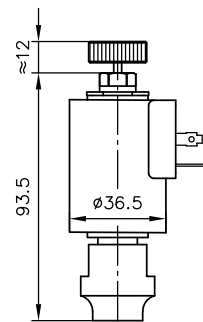
Coding **VA, ZA**



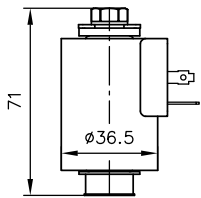
Coding **ZAM**



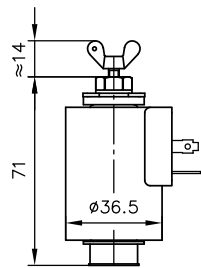
Coding **ZAP**



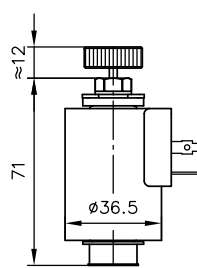
Coding **V, Z**



Coding **ZM**



Coding **ZP**

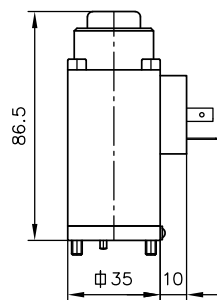


**Only for PSL 3 Z.../D...-2:**

Without coding



Coding **F, D**

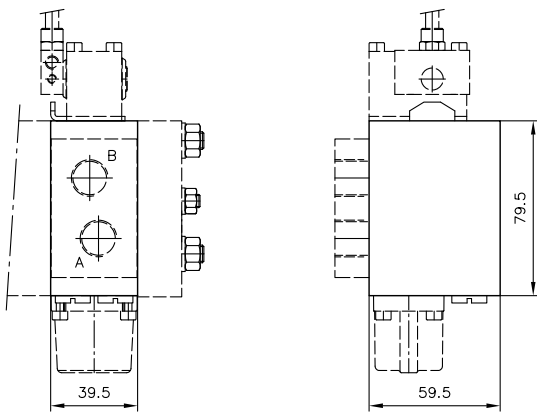


## 4.2 Valve section

### 4.2.1 Directional valve section

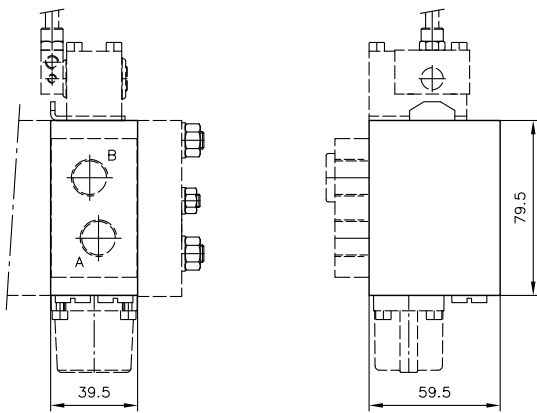
#### Directional valve section without integrated threads for combining with an ancillary block

(Coding - A... as per ["Table 10: Consumer ports"](#))



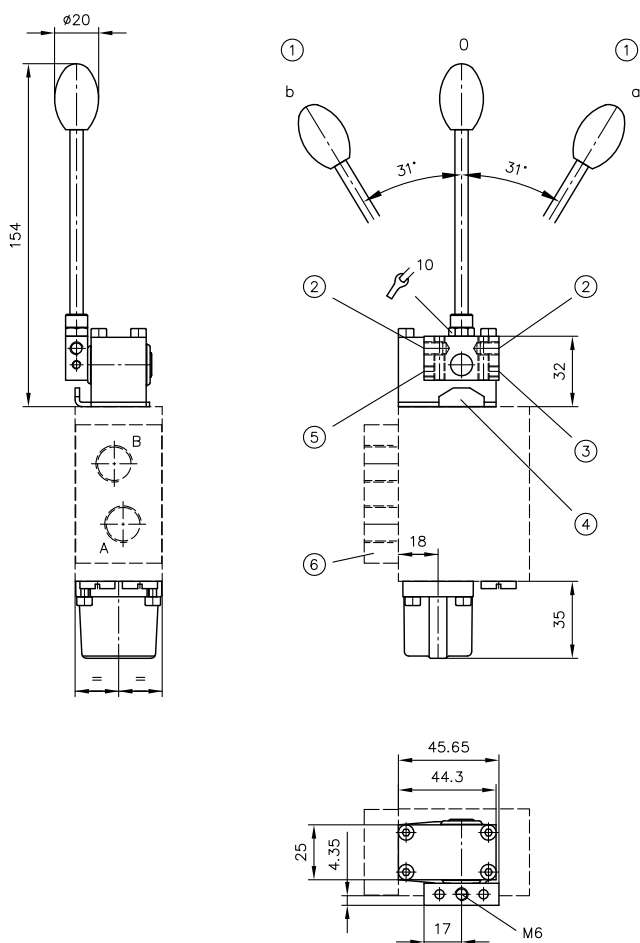
#### Pre-selector directional valve section with integrated ports

(Coding - 8... as per ["Table 11: Valve section, 2-way controller"](#))



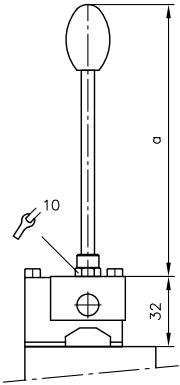
**Directional valve section with manual actuation**

Actuation **EOA, EOC**



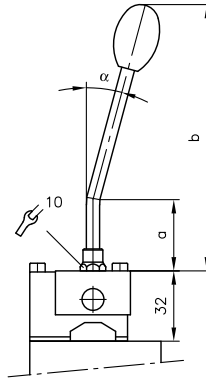
- 1 Switching position 0, a and b
- 2 Alternative mounting position for hand lever (thread M6, 8.5 mm deep)
- 3 Travel stop for flow limitation at A (adjustable via grub screw M5)
- 4 Intermediate sheet to act as stop for stroke limitation
- 5 Travel stop for flow limitation at B (adjustable via grub screw M5)
- 6 Ancillary blocks

Lever straight



Coding	a
Without coding	122
1	--
2	78
3	174
4	92

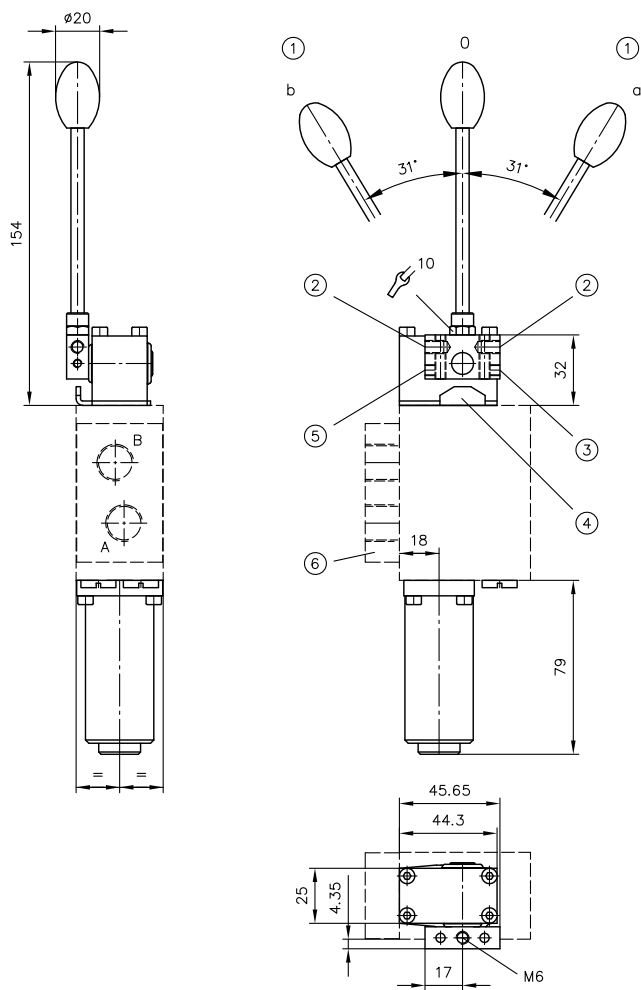
Lever for angle



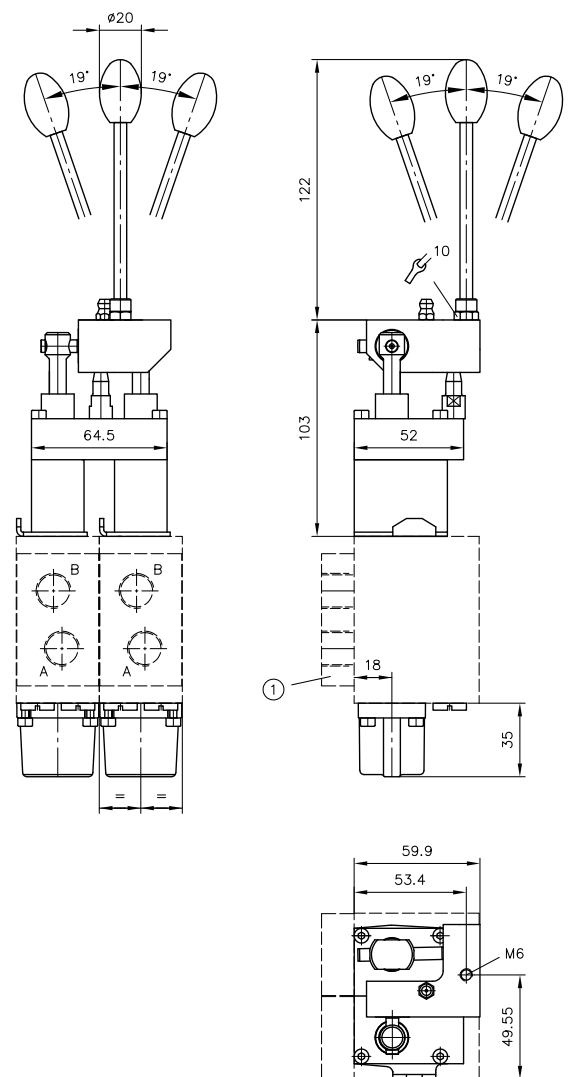
Coding	a	b	$\alpha$
005	31	122	5°
015	31	120	15°
025	31	115	25°
030	49	114	30°



Actuation **EOAR**



Actuation **EOK**

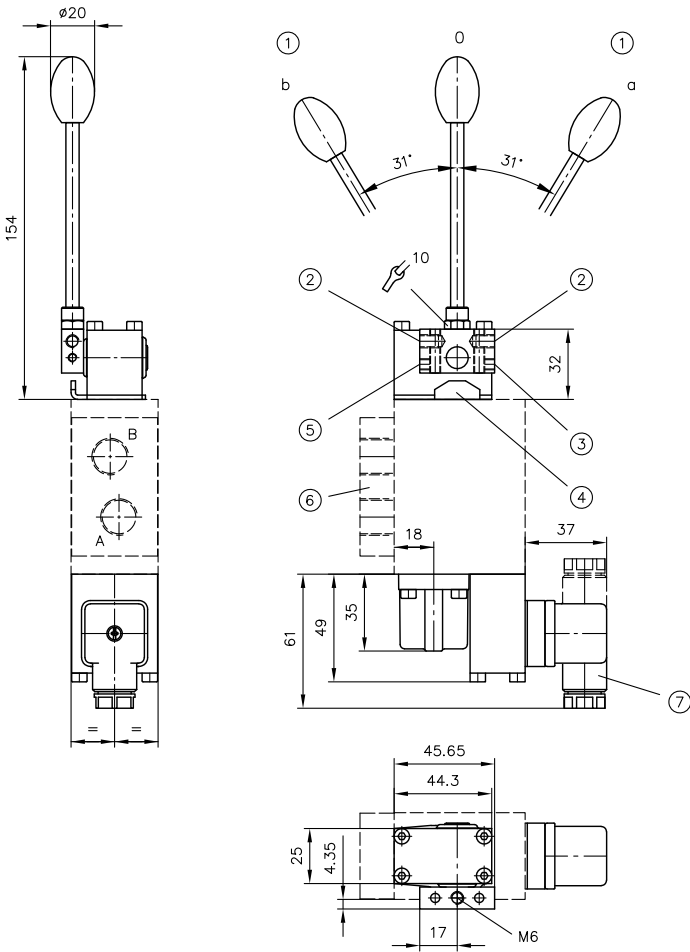


- 1 Switching position 0, a and b
- 2 Alternative mounting position for hand lever (thread M6, 8.5 mm deep)
- 3 Travel stop for flow limitation at A (adjustable via grub screw M5)
- 4 Intermediate sheet to act as stop for stroke limitation
- 5 Travel stop for flow limitation at B (adjustable via grub screw M5)
- 6 Ancillary blocks

- 1 Ancillary blocks

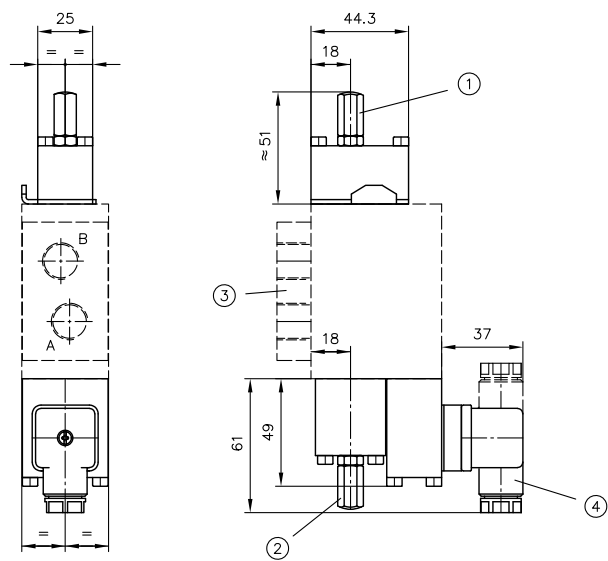
**Directional valve section with electro-hydraulic actuation**

Actuation EA



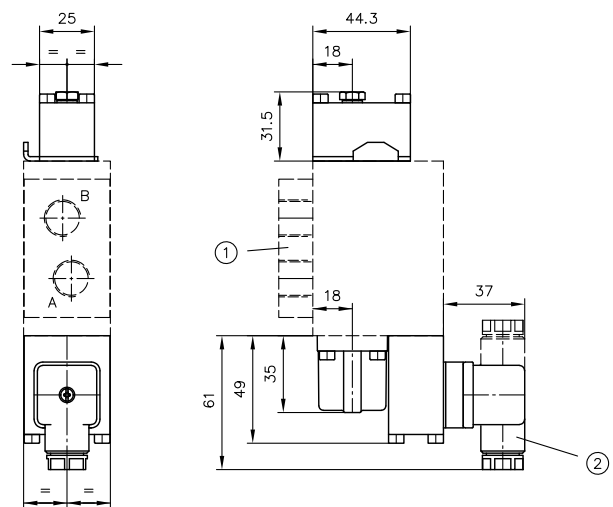
- 1 Switching position 0, a and b
- 2 Alternative mounting position for hand lever (thread M6, 8.5 mm deep)
- 3 Travel stop for flow limitation at A (adjustable via grub screw M5)
- 4 Intermediate sheet to act as stop for stroke limitation
- 5 Travel stop for flow limitation at B (adjustable via grub screw M5)
- 6 Ancillary blocks
- 7 Male connector can be mounted offset by 180°

Actuation **E**



- 1 Travel stop for flow limitation at A
- 2 Travel stop for flow limitation at B
- 3 Ancillary blocks
- 4 Male connector can be mounted offset by 180°

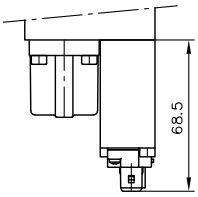
Actuation **EI**



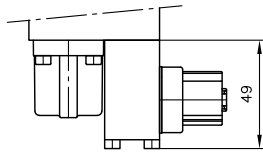
- 1 Ancillary blocks
- 2 Male connector can be mounted offset by 180°

Solenoid version drawings

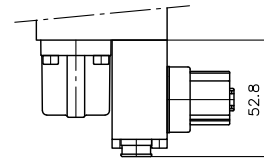
Coding AMP 12(24) K4



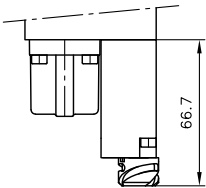
Coding DT 12(24)



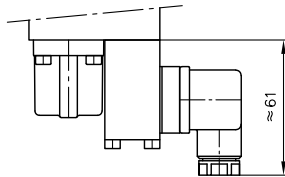
Coding DT 12(24) T



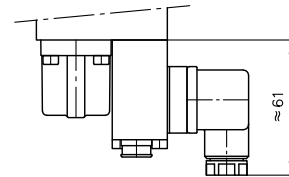
Coding S 12(24)



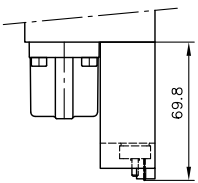
Coding G(X) 12(24)



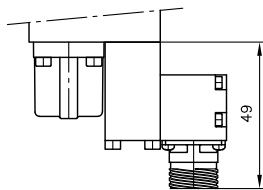
Coding G(X) 12(24) T



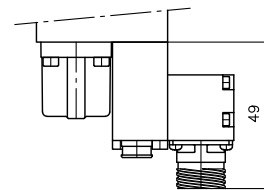
Coding G(X) 24 C4



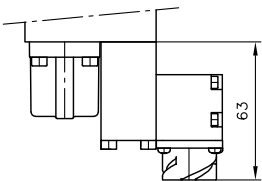
Coding DTL 12(24)



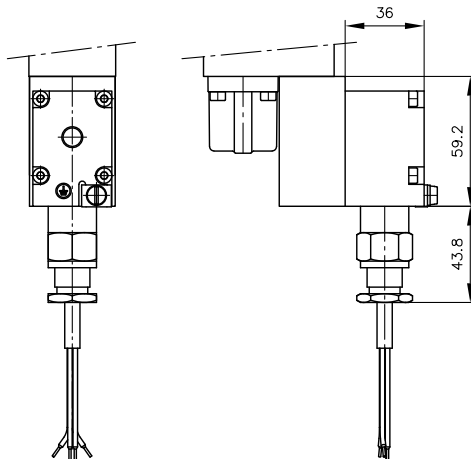
Coding DTL 12(24) T



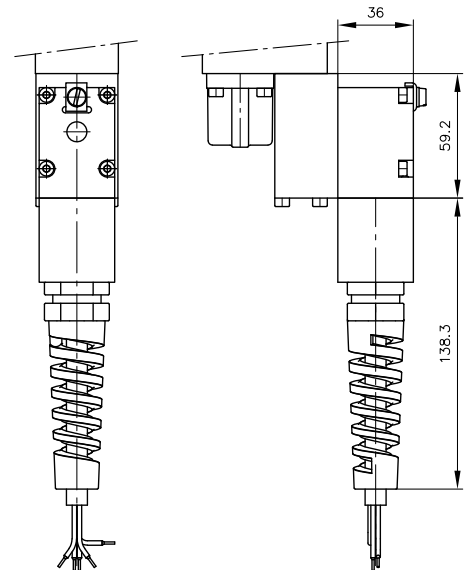
Coding ITT 12(24)



Coding G 24 MP2F

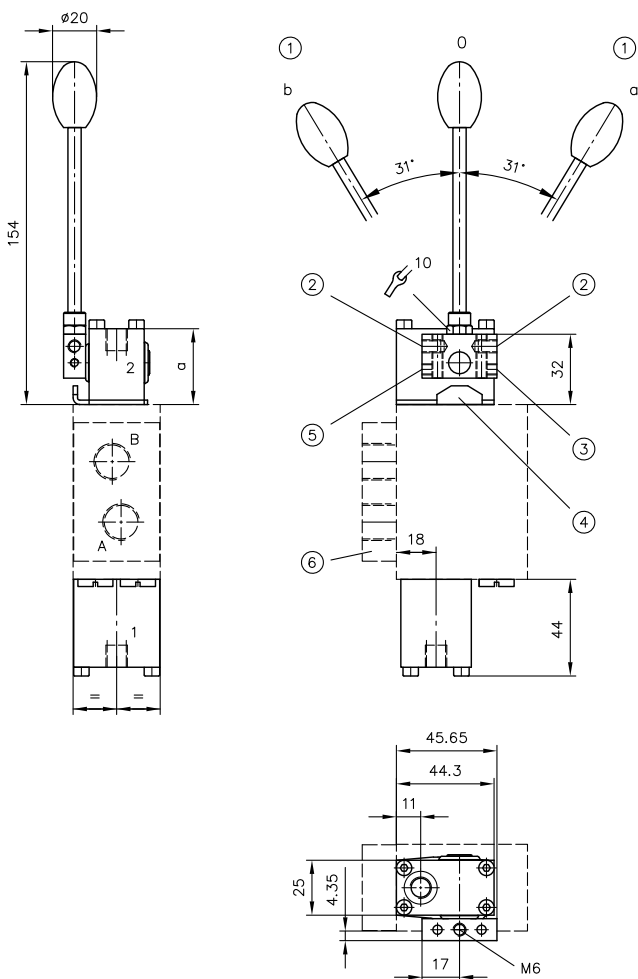


Coding G 24 TEX 4 55FM

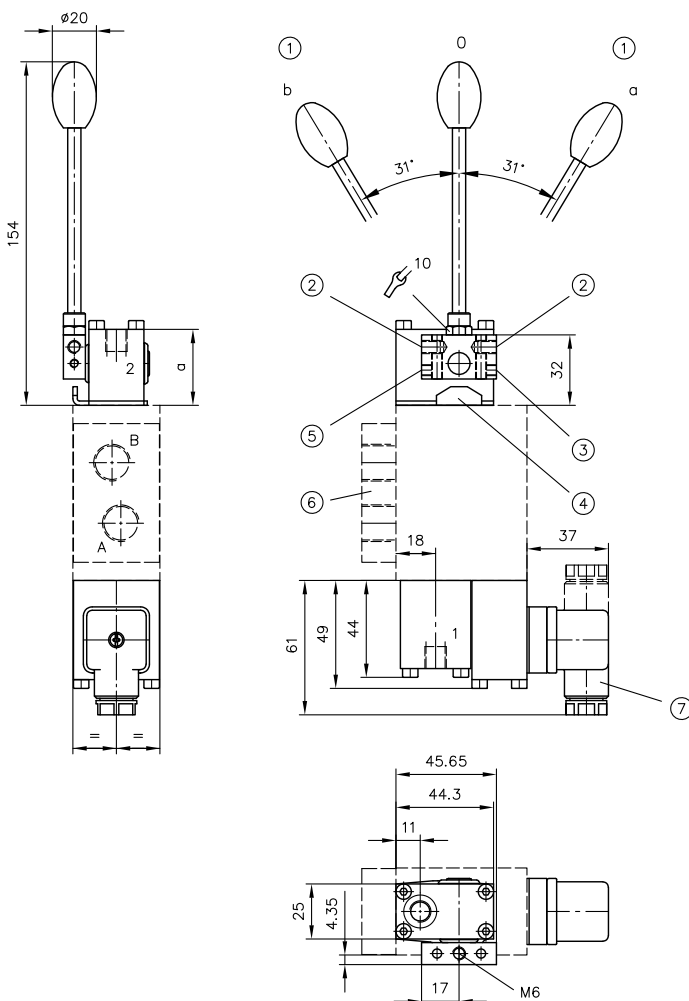


**Directional valve section with hydraulic actuation**

Actuation EOHA (UNF)



Actuation EHA (UNF)

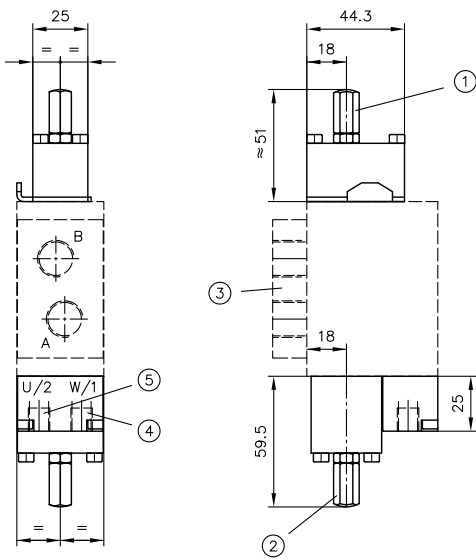


- 1 Switching position 0, a and b
- 2 Alternative mounting position for hand lever (thread M6, 8.5 mm deep)
- 3 Travel stop for flow limitation at A (adjustable via grub screw M5)
- 4 Intermediate sheet to act as stop for stroke limitation
- 5 Travel stop for flow limitation at B (adjustable via grub screw M5)
- 6 Ancillary blocks

Coding	a
EOHA, EHA	34.5
EOHA UNF, EHA UNF	39.5

Coding	Ports as per ISO 228-1 or SAE J 514
EOHA, EHA	1, 2
EOHA UNF, EHA UNF	G 1/8
EOHA UNF, EHA UNF	SAE-2 (5/16-24 UNF-2B)

Actuation **EOZ (UNF)**



- 1 Travel stop for flow limitation at A
- 2 Travel stop for flow limitation at B
- 3 Ancillary blocks
- 4 Port W/1
- 5 Port U/2

**Coding**

**Ports as per ISO 228-1 or SAE J 514**

**W/1, U/2**

EOZ

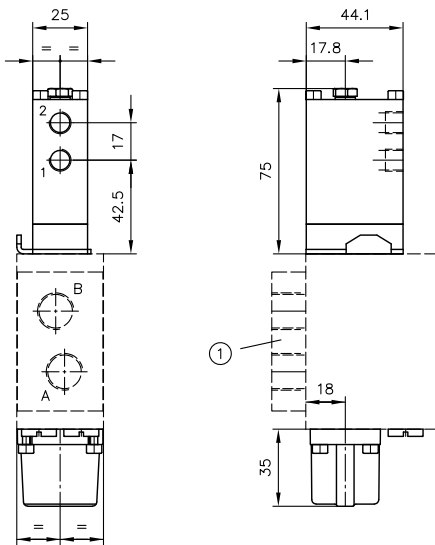
G 1/8

EOZ UNF

SAE-2 (5/16-24 UNF-2B)

**Directional valve section with pneumatic actuation**

Actuation P

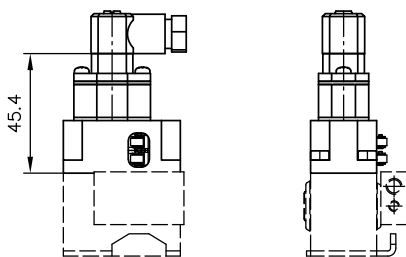


1 Ancillary blocks

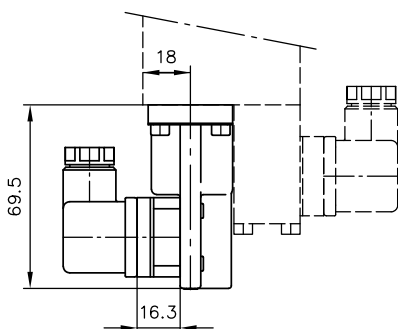
<b>Coding</b>	<b>Ports as per ISO 228-1</b>
	<b>1, 2</b>
P	G 1/8

**Switching position monitoring, displacement transducer**

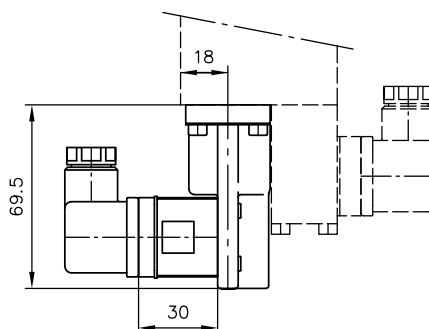
Coding VC



Coding WA

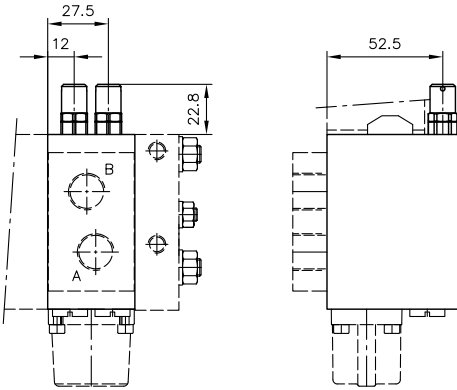


Coding U



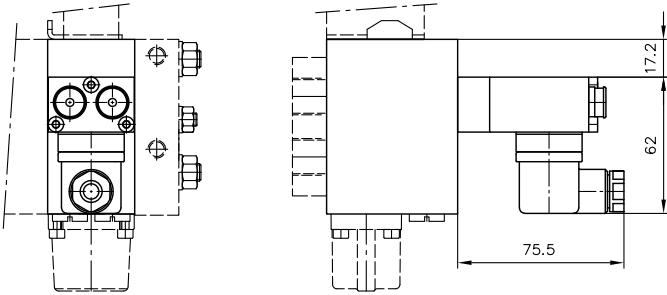
**Directional valve section with LS pressure limitation**

Coding A., B., A.. B..

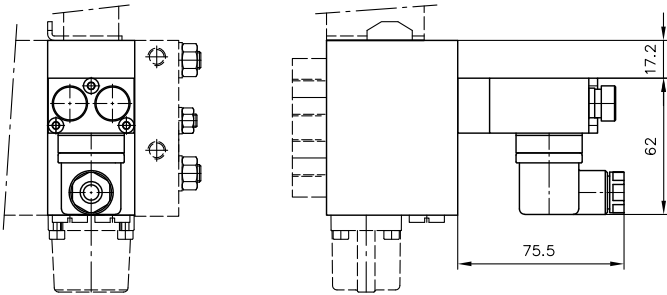


**Directional valve section with electric LS relief or LS pressure limitation**

Coding FP



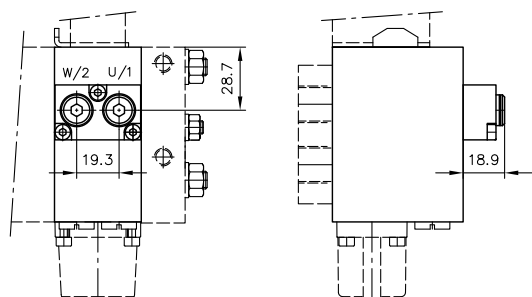
Coding FPH





**Directional valve section with LS port for external limitation**

Coding **S1**



**Coding**

**Ports as per ISO 228-1**

**U/1, W/2**

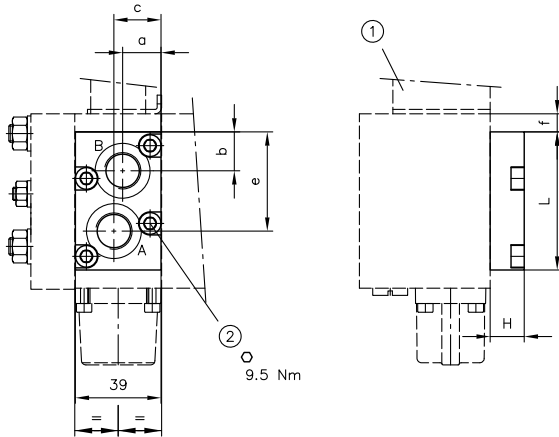
S1

G 1/8

## 4.2.2 Ancillary block

as per [Chapter 2.3.2, "Ancillary block"](#)

/2, /22, /3  
/UNF 1, /UNF 12, /UNF 2  
/JIS 2



- 1 Directional valve section  
2 Cylinder screws ISO 4762-M6x g -A2-70

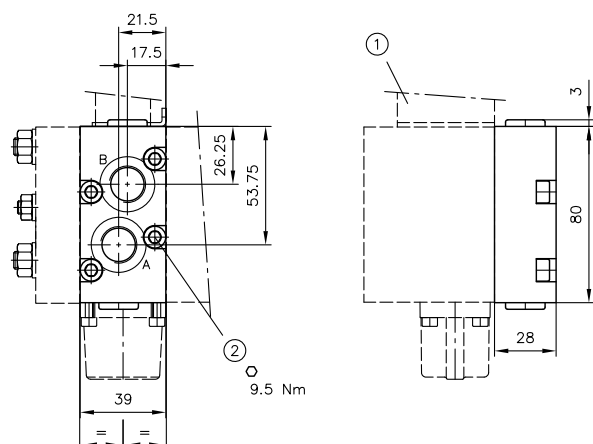
Coding	H	L	a	b	c	e	f	g
/2	15.5	63	17.5	17.75	21.5	42.25	8.25	16
/22	24.5	68	21	13	18	55	5.25	25
/3	28	80	17.5	28.5	17.5	56	--	28
/UNF 1 /UNF 22 /UNF 2	16	63	17.5	17.75	21.5	45.25	8.25	16
/JIS 2	25	80	17.5	26.25	21.5	53.75	--	25

### Ports as per ISO 228-1 or SAE J 514 or JIS B 2351

#### A, B

/2, /22	G 3/8
/3	G 1/2
/UNF 1	7/16-20 UNF-2B (SAE-4)
/UNF 22	9/16-18 UNF-2B (SAE-6)
/UNF 2	3/4-16 UNF-2B (SAE-8)
/JIS 2	JIS G 3/8

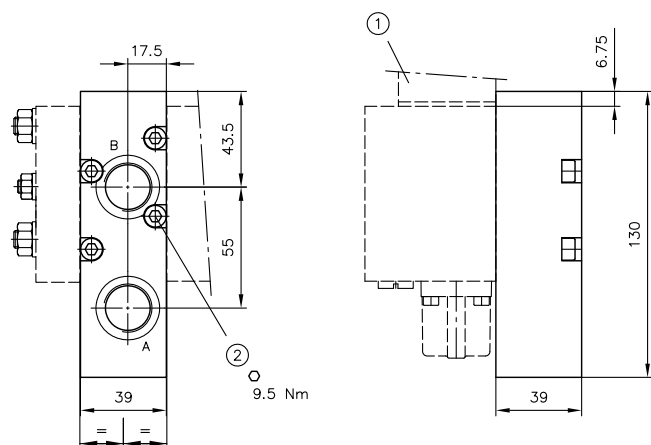
/2 M  
/UNF 2 M



- 1 Directional valve section
- 2 Cylinder screws ISO 4762-M6x 24 -A2-70

Coding	Ports as per ISO 228-1 or SAE J 514
	<b>A, B</b>
/2 M	G 3/8
/UNF 2 M	3/4-16 UNF-2B (SAE-8)

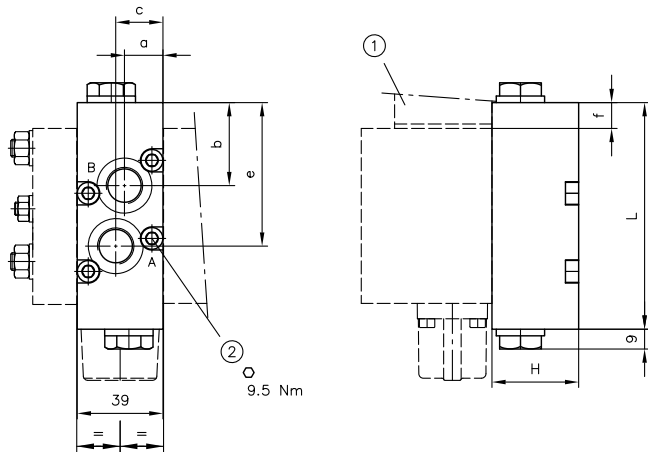
/M 222



- 1 Directional valve section
- 2 Cylinder screws ISO 4762-M6x 35 -A2-70

Coding	Ports
	<b>A, B</b>
/M 222	M22x1.5

/2(22) AS..BS.., /UNF 2 AS..BS..  
/2(22) AN..BN.., /UNF 2 AN..BN..



- 1 Directional valve section  
2 Cylinder screws ISO 4762-M6x g -A2-70

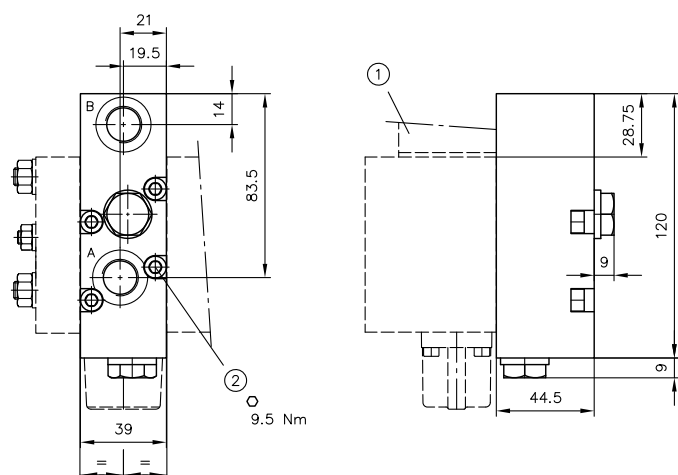
Coding	H	L	a	b	c	e	f	g
/2 AS.. BS.. /UNF 2 AS..BS..	39.5	83	17.5	27.5	21.5	55.25	1.75	40
/22 AS..BS..	39	105	20.2	22.5	19.5	83.5	1.75	39
/2 AN..BN.. /UNF 2 AN..BN..	29.5	103	17.5	37.75	21.5	65.25	11.75	40

**Ports as per ISO 228-1 or SAE J 514**

**A, B**

/2 AS..BS.. /22 AS..BS.. /2 AN..BN..	G 3/8
/UNF 2 AS..BS.. /UNF 2 AN..BN..	3/4-16 UNF-2B (SAE-8)

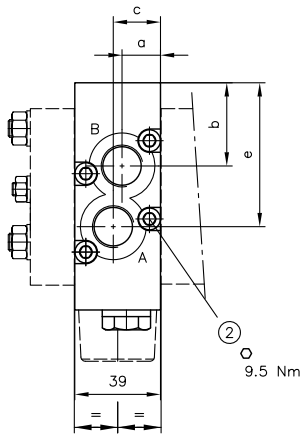
/22 AN..BN..



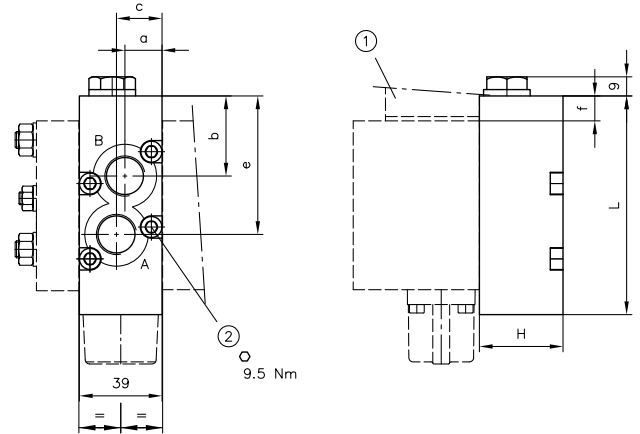
- 1 Directional valve section
- 2 Cylinder screws ISO 4762-M6x 45 -A2-70

Coding	Ports as per ISO 228-1
	A, B
/22 AN..BN..	G 3/8

/22 AN..  
/UNF 2 AN..



/22 BN..  
/UNF 2 BN..



- 1 Directional valve section
- 2 Cylinder screws ISO 4762-M6x g -A2-70

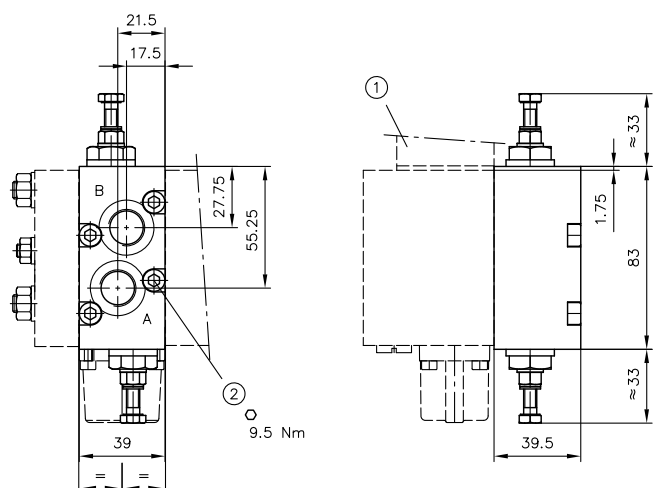
Coding	H	L	a	b	c	e	f	g
/22 AN..	39	110	19.5	13.75	21	74.25	19.5	39
/22 BN..	39	110	18	35.75	19.5	96.25	11	39
/UNF 2 AN.. /UNF 2 BN..	39.5	103	17.5	37.75	21.5	65.25	11.75	40

**Ports as per ISO 228-1 or SAE J 514**

**A, B**

/22 AN.. /22 BN..	G 3/8
/UNF 2 AN.. /UNF 2 BN..	3/4-16 UNF-2B (SAE-8)

**/2 AS..R BS..R**



- 1 Directional valve section
- 2 Cylinder screws ISO 4762-M6x 40 -A2-70

**Coding**

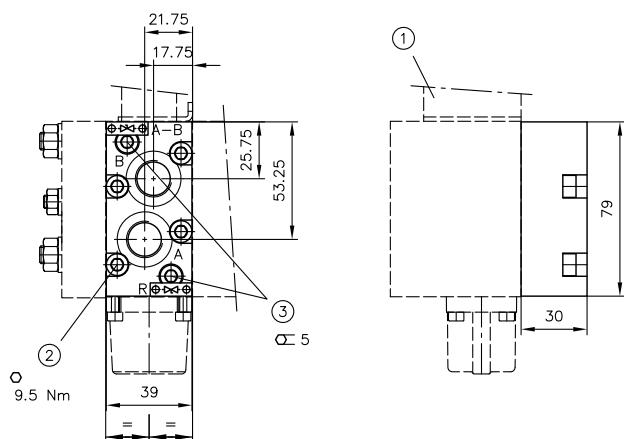
Ports as per ISO 228-1

A, B

/2 AS..R BS..R

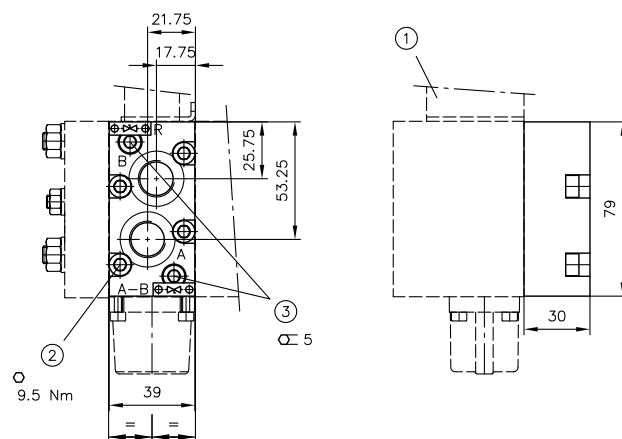
G 3/8

**/2 A HN**



- 1 Directional valve section
- 2 Cylinder screws ISO 4762-M6x 25 -A2-70
- 3 Drain screw

**/2 B HN**



**Coding**

Ports as per ISO 228-1

A, B

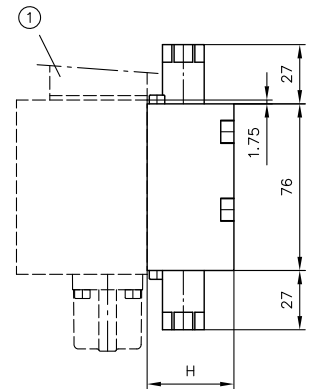
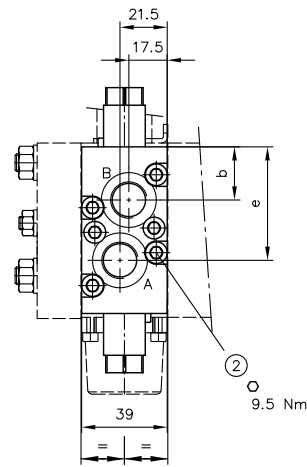
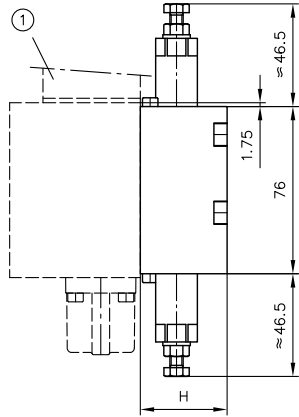
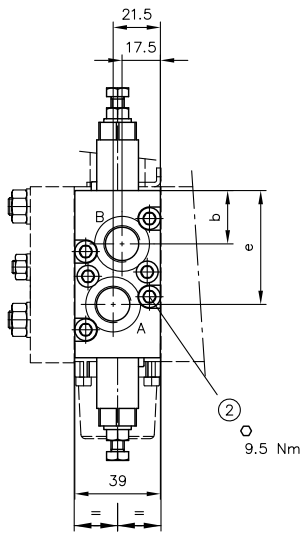
/2 A HN

G 3/8

/2 B HN

/2 AL-0.. - BL-0..  
/UNF 2 AL-0.. - BL-0..

/2 ALX-0.. - BLX-0..  
/UNF 2 ALX-0.. - BLX-0..



- 1 Directional valve section  
2 Cylinder screws ISO 4762-M6x g -A2-70

Coding	H	b	e	g
/2 AL-0.. - BL-0.. /2 ALX-0.. - BLX-0..	39.5	25.25	51.75	40
/UNF 2 AL-0.. - BL-0.. /UNF 2 ALX-0.. - BLX-0..	44.5	23.5	52.5	45

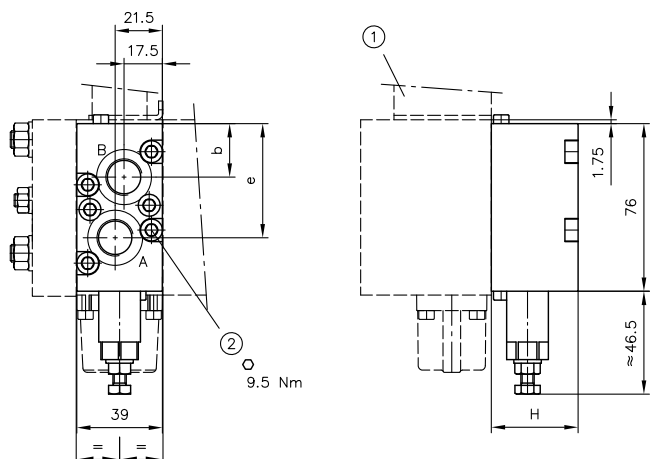
Ports as per ISO 228-1 or SAE J 514

A, B

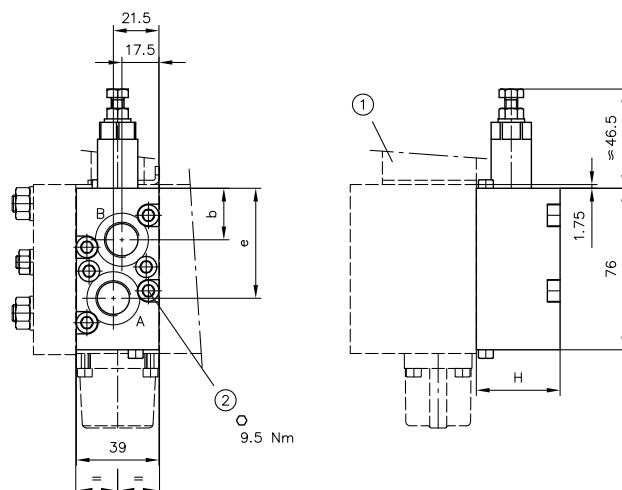
/2 AL-0.. - BL-0.. /2 ALX-0.. - BLX-0..	G 3/8
/UNF 2 AL-0.. - BL-0.. /UNF 2 ALX-0.. - BLX-0..	3/4-16 UNF-2B (SAE-8)



/2 AL-0..  
/UNF 2 AL-0..



/2 BL-0..  
/UNF 2 BL-0..



- 1 Directional valve section  
2 Cylinder screws ISO 4762-M6x g -A2-70

Coding	H	b	e	g
/2 AL-0.. /2 BL-0..	39.5	25.25	51.75	40
/UNF 2 AL-0.. /UNF 2 BL-0..	44.5	23.5	52.5	45

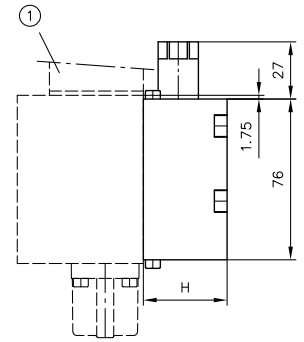
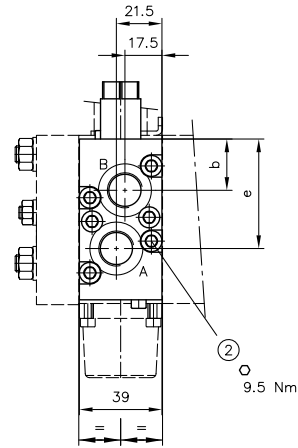
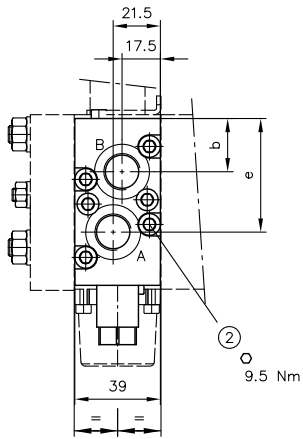
Ports as per ISO 228-1 or SAE J 514

A, B

/2 AL-0.. /2 BL-0..	G 3/8
/UNF 2 AL-0.. /UNF 2 BL-0..	3/4-16 UNF-2B (SAE-8)

/2 ALX-0..  
/UNF 2 ALX-0..

/2 BLX-0..  
/UNF 2 BLX-0..



- 1 Directional valve section
- 2 Cylinder screws ISO 4762-M6x g -A2-70

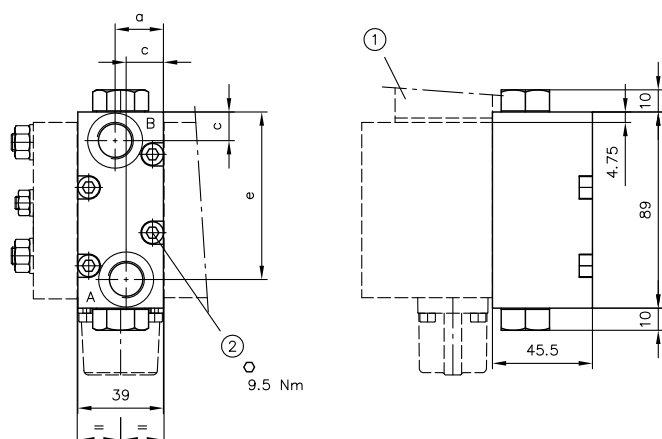
Coding	H	b	e	g
/2 ALX-0.. /2 BLX-0..	39.5	25.25	51.75	40
/UNF 2 ALX-0.. /UNF 2 BLX-0..	44.5	23.5	52.5	45

**Ports as per ISO 228-1 or SAE J 514**

**A, B**

/2 ALX-0.. /2 BLX-0..	G 3/8
/UNF 2 ALX-0.. /UNF 2 BLX-0..	3/4-16 UNF-2B (SAE-8)

/2 DRH, /2 DRH A, /2 DRH B  
 /UNF 2 DRH, /UNF 2 DRH A, /UNF 2 DRH B



- 1 Directional valve section
- 2 Cylinder screws ISO 4762-M6x 46 -A2-70

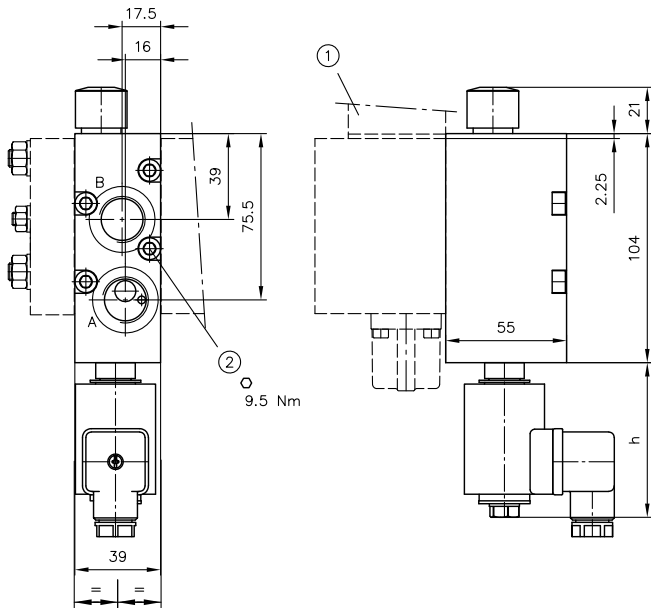
Coding	a	c	e
/2 ALX-0.. /2 BLX-0..	22	17	76
/UNF 2 ALX-0.. /UNF 2 BLX-0..	21.5	17.5	73.5

Ports as per ISO 228-1 or SAE J 514

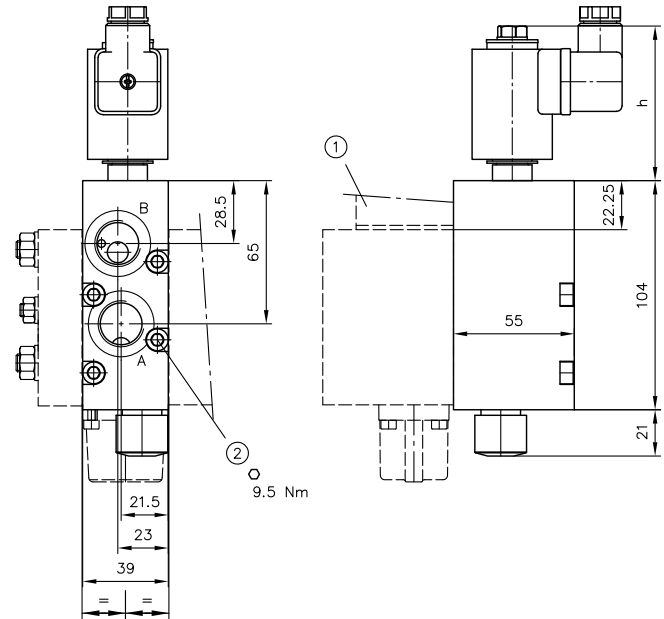
A, B

/2 DRH /2 DRH A /2 DRH B	G 3/8
/UNF 2 DRH /UNF 2 DRH A /UNF 2 DRH B	3/4-16 UNF-2B (SAE-8)

/3 AVT  
/3 AVPT



/3 BVT  
/3 BVPT



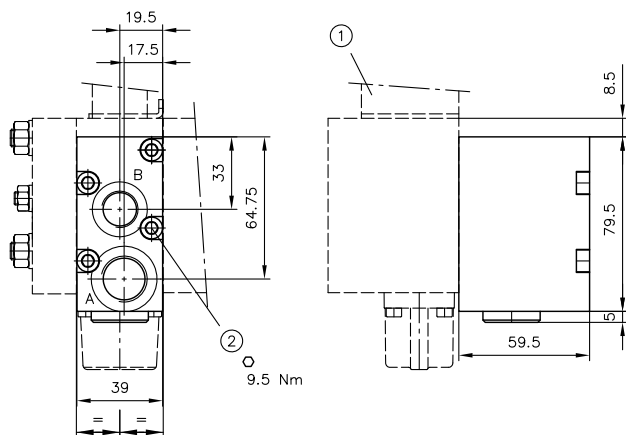
- 1 Directional valve section
- 2 Cylinder screws ISO 4762-M6x 55 -A2-70

Coding	h
/3 AVT /3 BVT	70.5
/3 AVPT /3 BVPT	74

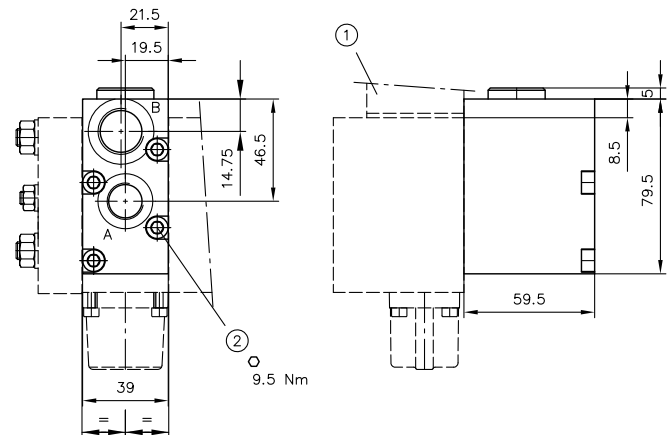
**Ports as per ISO 228-1**

<b>A, B</b>	
/3 AVT /3 AVPT /3 BVT /3 BVPT	G 1/2

**/32 DFA**



**/32 DFB**



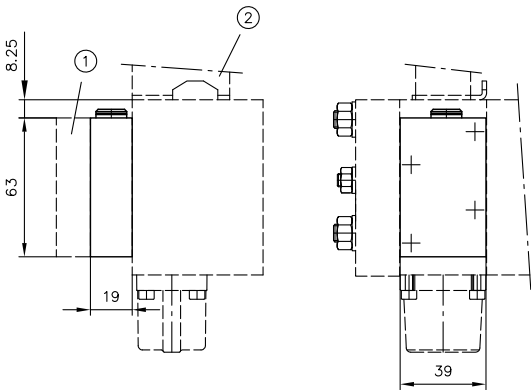
- 1 Directional valve section
- 2 Cylinder screws ISO 4762-M6x 60 -A2-70

Coding	Ports as per ISO 228-1	
	A	B
/32 DFA	G 1/2	G 3/8
/32 DFB	G 3/8	G 1/2

### 4.2.3 Intermediate plate

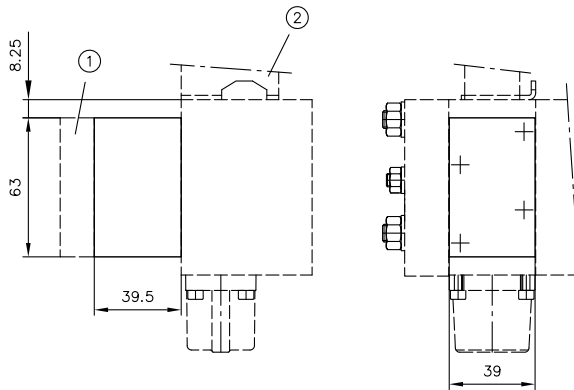
as per [Chapter 2.3.3, "Intermediate plate \(on the consumer side\)"](#)

/Z20

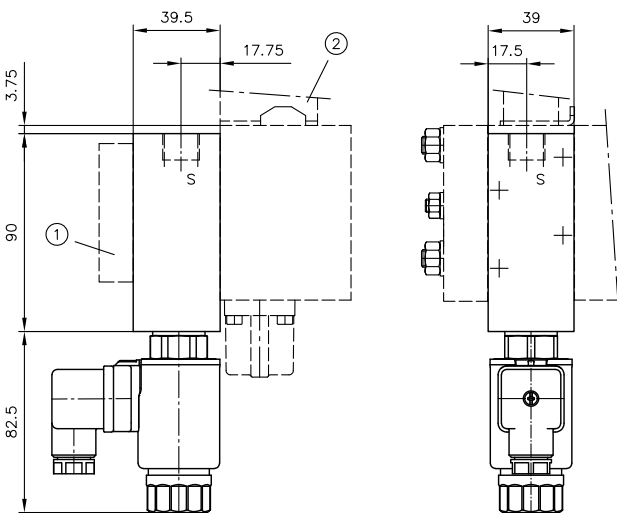


- 1 Ancillary block
- 2 Directional valve section

/Z40

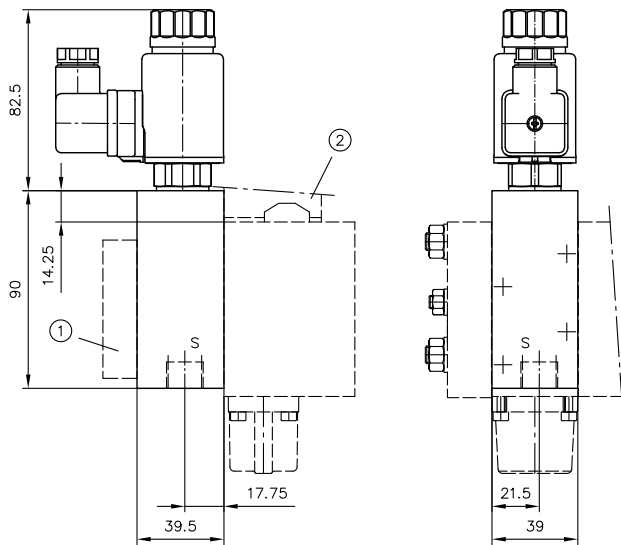


/Z2A BVE 1 R(S) B



- 1 Ancillary block
- 2 Directional valve section

/Z2B BVE 1 R(S) B



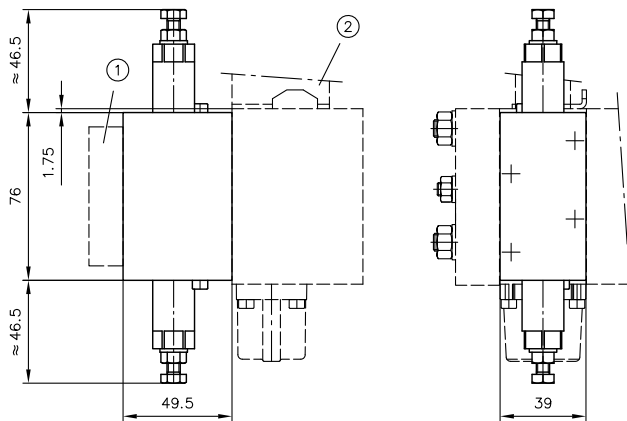
Coding

Ports as per ISO 228-1

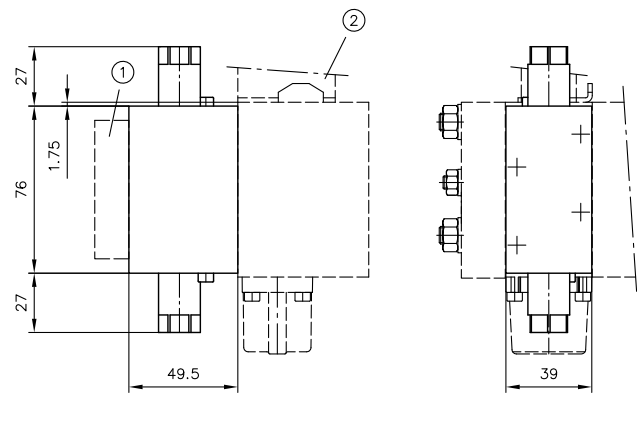
/Z2A BVE 1 R(S) B  
/Z2B BVE 1 R(S) B

S  
G 3/8

**/Z AL...BL...**

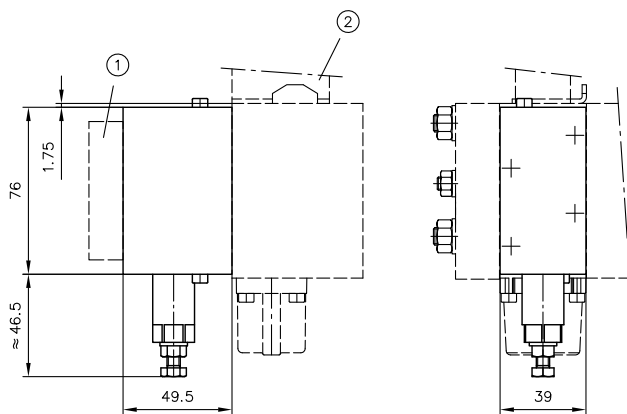


**/Z ALX...BLX...**

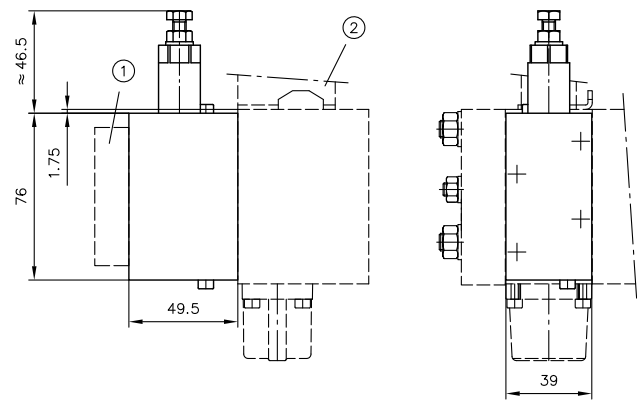


- 1 Ancillary block
- 2 Directional valve section

**/Z AL-...**

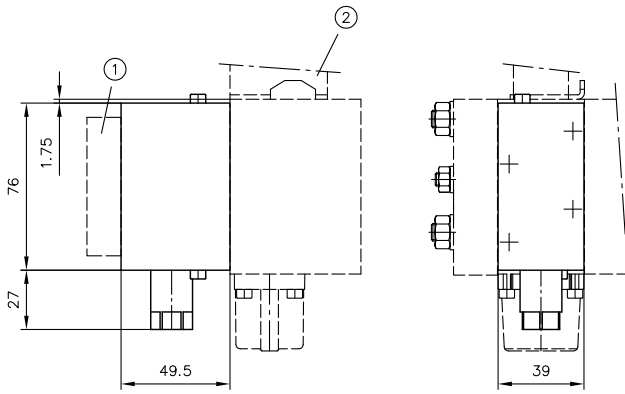


**/Z BL-...**



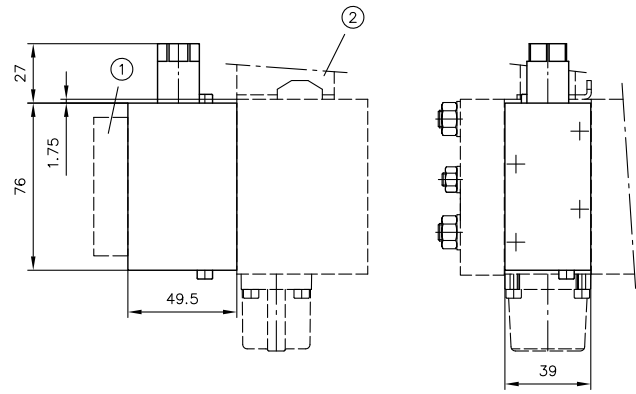
- 1 Ancillary block
- 2 Directional valve section

**/Z ALX-...**

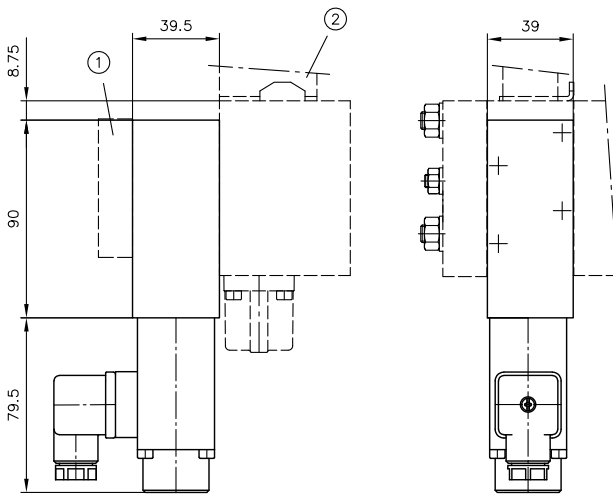


- 1 Ancillary block
- 2 Directional valve section

**/Z BLX-...**

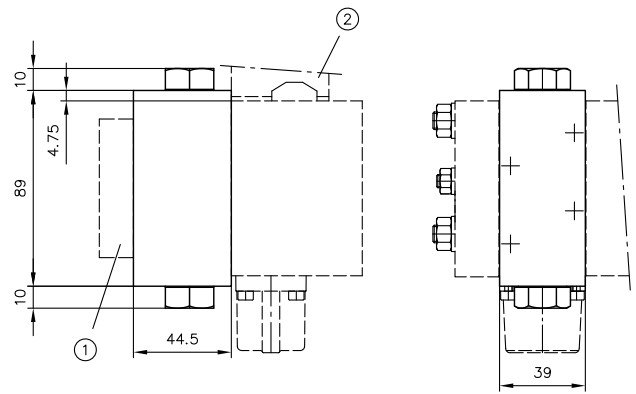


**/ZDR  
/ZDS**



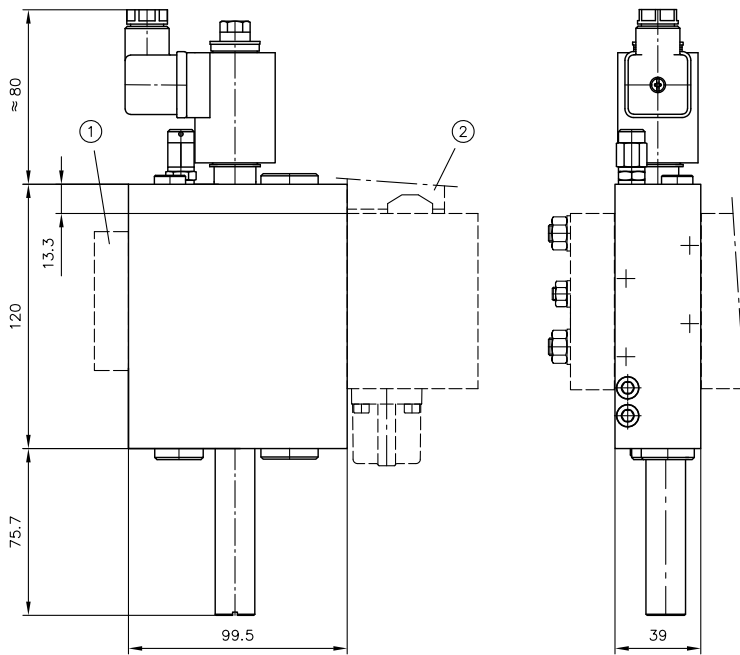
- 1 Ancillary block
- 2 Directional valve section

**/ZDRH**



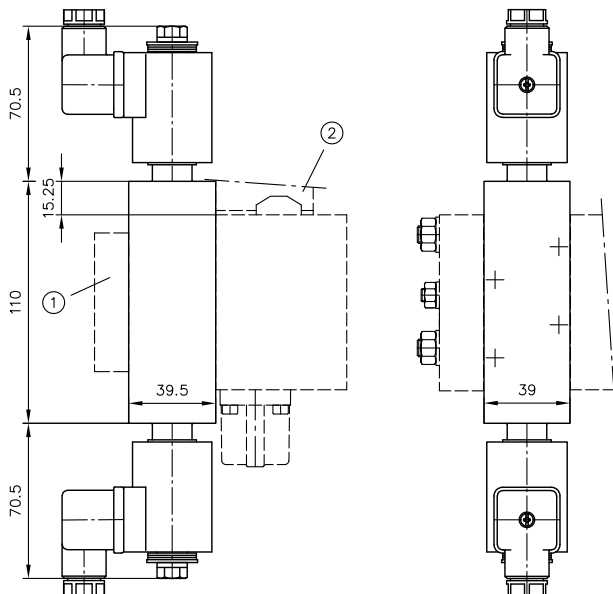


/ZN...  
/ZNX...

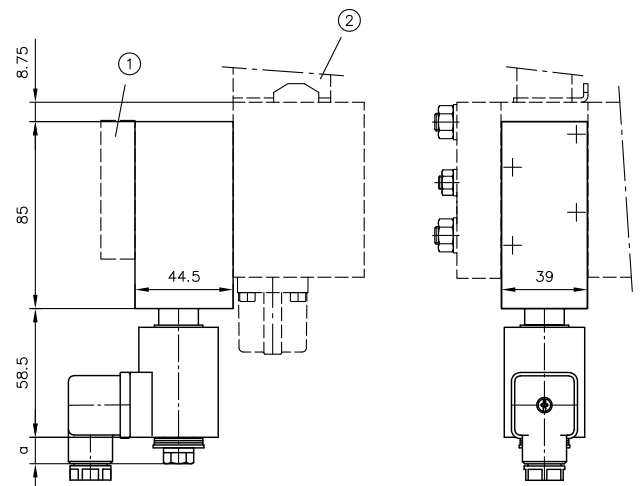


- 1 Ancillary block
- 2 Directional valve section

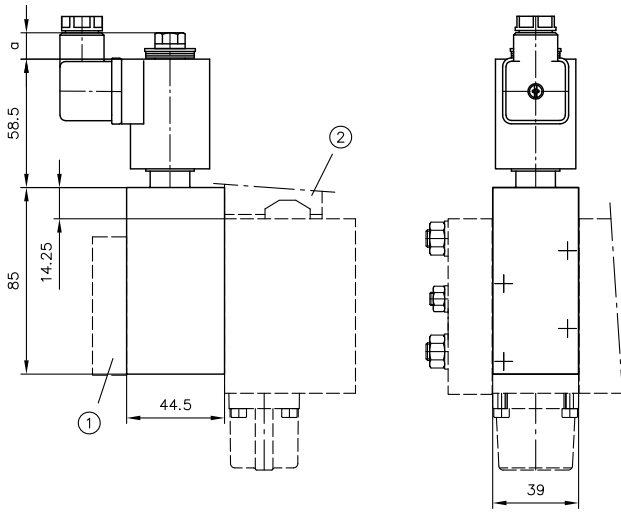
/ZSS  
/ZVV



/ZVX  
/ZVPX



/ZXV  
/ZXVP



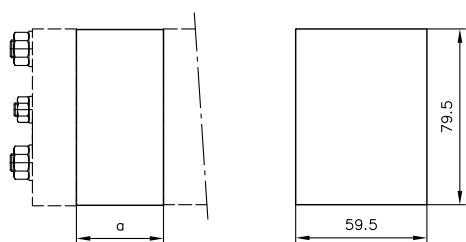
- 1 Ancillary block
- 2 Directional valve section

Coding	a
EM 22	12
EMP 22	15

### 4.3 Series intermediate plate

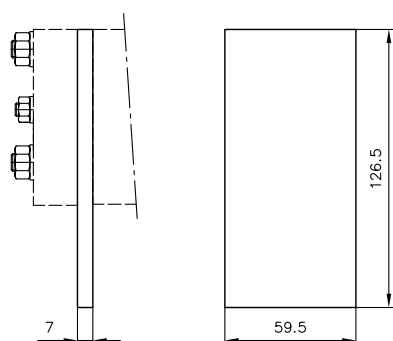
as per [Chapter 2.4, "Series intermediate plate"](#)

ZPL 22  
ZPL 22/7  
ZPL 22/15

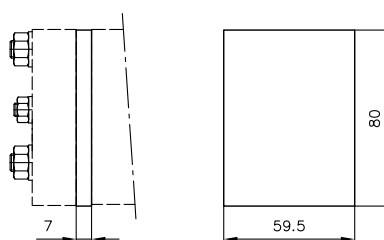


Coding	a
ZPL 22	39.5
ZPL 22/7	7
ZPL 22/15	14.5

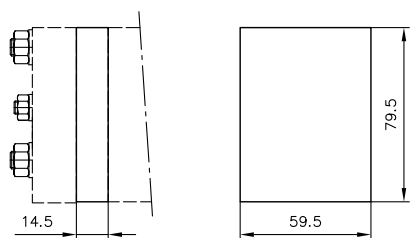
ZPL 22/7 EX



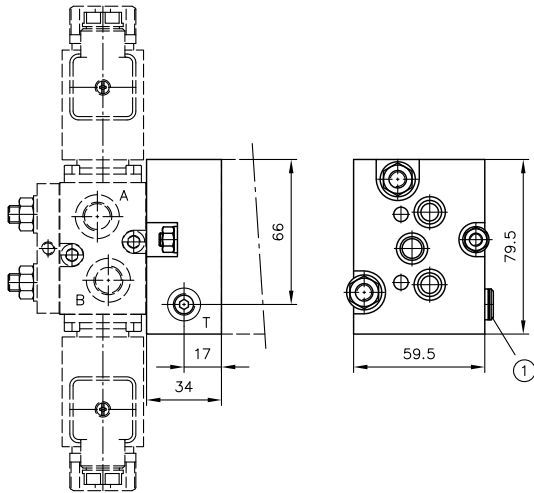
ZPL 22/7/XRT



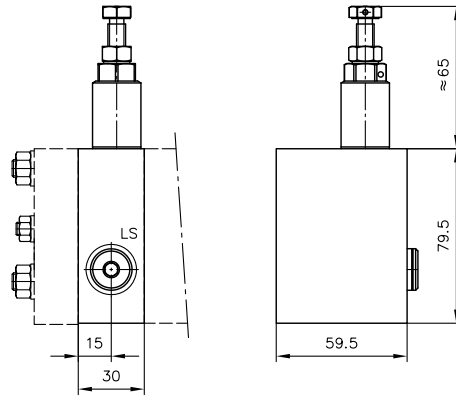
ZPL 22/15/R1  
ZPL 22/15/R2  
ZPL 22/15/XR



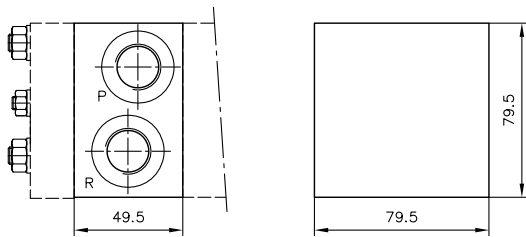
ZPL 2-SWS 2  
ZPL 2-SWS 2/RB



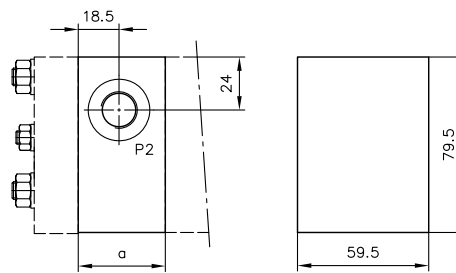
ZPL LS/...



ZPL 2 P3R3



ZPL 2-Z2

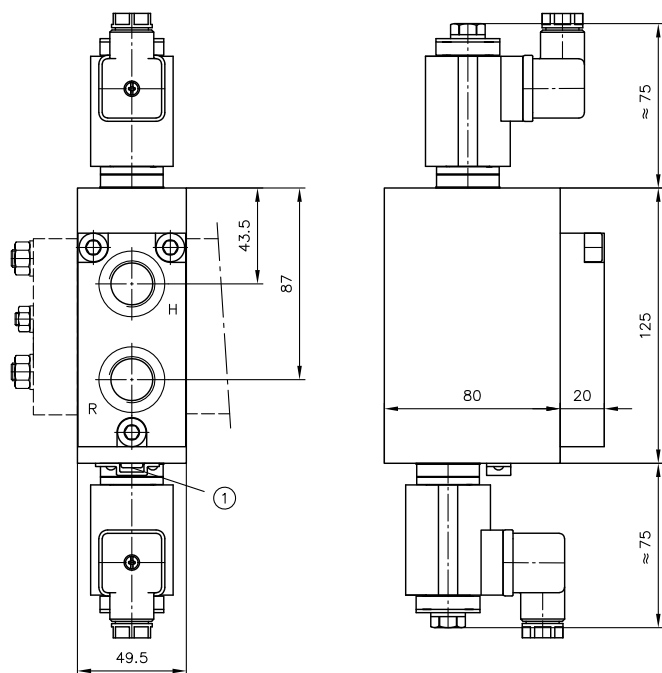


**Coding**

**Ports as per ISO 228-1**

	T	LS	R, P	P2
ZPL 2-SWS 2 ZPL 2-SWS 2/RB	G 1/8	--	--	--
ZPL LS/...	--	G 1/4	--	--
ZPL 2 P3R3	--	--	G 1/2	--
ZPL 2-Z2	--	--	--	G 3/8

A1 RR .././3  
A1 RR .././4



1 Drain screw

**Coding**

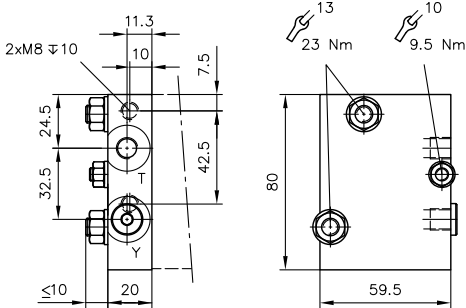
**Ports as per ISO 228-1**

Coding	Ports as per ISO 228-1
	<b>H, R</b>
A1 RR .././3	G 1/2
A1 RR .././4	G 3/4

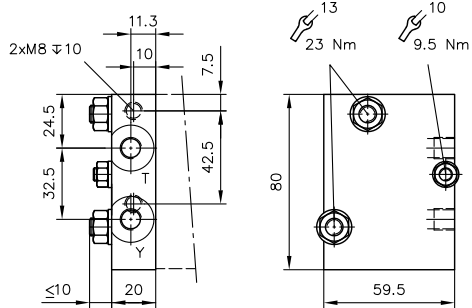
## 4.4 End plate

as per [Chapter 2.5, "End plate"](#)

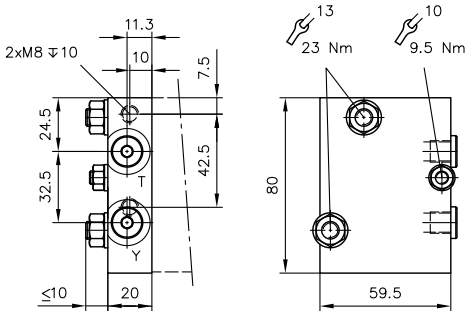
### E 1, E 1 UNF



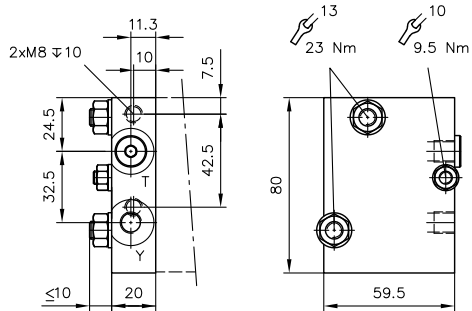
### E 2, E 2 UNF



### E 4, E 4 UNF



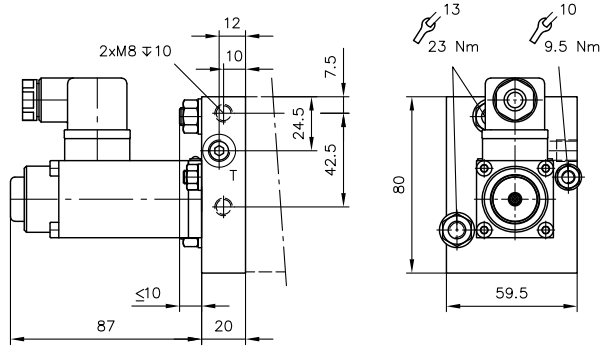
### E 5, E 5 UNF



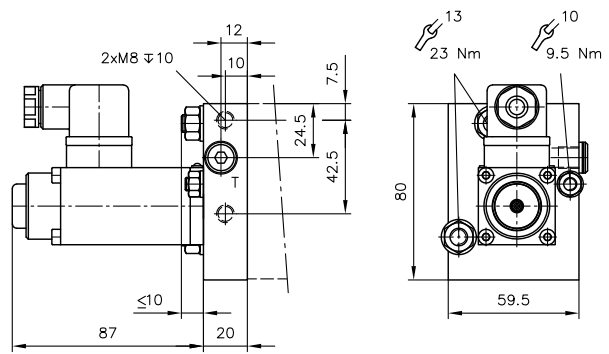
- **E 1 (UNF):** T - open, Y - sealed
- **E 2 (UNF):** T - open, Y - open
- **E 4 (UNF):** T - sealed, Y - sealed
- **E 5 (UNF):** T - sealed, Y - open

Coding	Ports as per ISO 228-1 or SAE J 514
	T and Y
E 1, E 2, E 4, E 5	G 1/8
E 1 UNF, E 2 UNF, E 4 UNF, E 5 UNF	SAE-4 (7/16-UNF-2B)

**E 3**



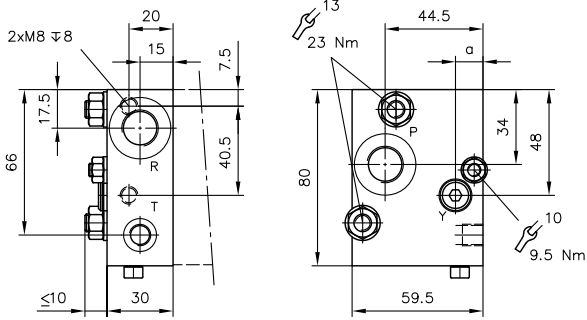
**E 6**



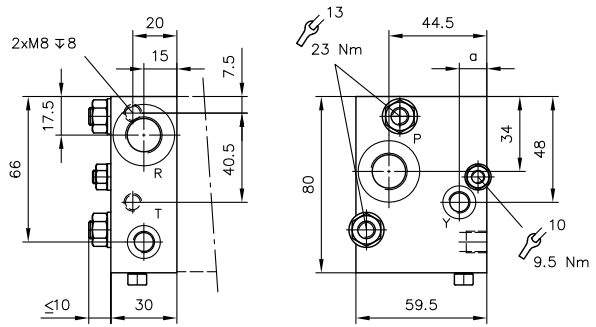
- **E 3:** T - open
- **E 6:** T - sealed

Coding	Ports as per ISO 228-1
	T
E 3, E 6	G 1/8

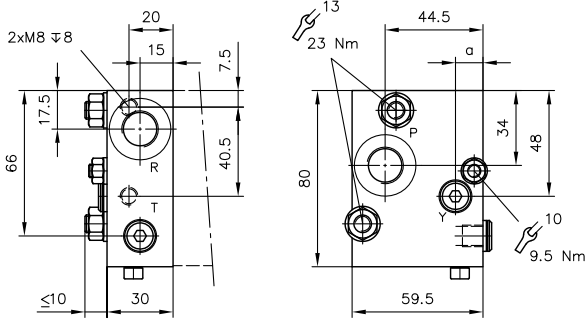
**E 17, E 17 UNF**



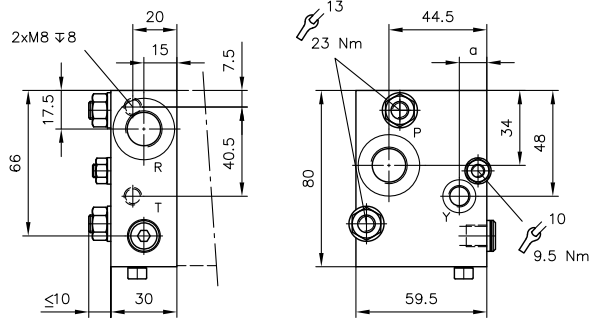
**E 18, E 18 UNF**



**E 19, E 19 UNF**



**E 20, E 20 UNF**



Coding	a
E 17, E 18, E 19, E 20	12.5
E 17 UNF, E 18 UNF, E 19 UNF, E 20 UNF	16

- **E 17 (UNF):** T - open, Y - sealed, P - open, R - open
- **E 18 (UNF):** T - open, Y - open, P - open, R - open
- **E 19 (UNF):** T - sealed, Y - sealed, P - open, R - open
- **E 20 (UNF):** T - sealed, Y - open, P - open, R - open

Coding	Ports as per ISO 228-1 or SAE J 514	
	T and Y	P and R
E 17, E 18, E 19, E 20	G 1/8	G 3/8
E 17 UNF, E 18 UNF, E 19 UNF, E 20 UNF	SAE-4 (7/16-UNF-2B)	SAE-8 (3/4-16 UNF-2B)



## 5 Assembly, operation and maintenance recommendations

### 5.1 Intended use

This valve is intended exclusively for use in hydraulic applications in fluid technology.

The user must observe the safety measures and warnings in this documentation.

#### Essential requirements for the product to function correctly and safely:

- All information in this documentation must be observed.
- The product must only be assembled and put into operation by qualified personnel.
- The product must only be operated within the specified technical parameters. The technical parameters are described in detail in this documentation.
- All components must be suitable for the operating conditions in the event of application in an assembly.
- The operating and maintenance manual of the components, assemblies and the specific complete system must also always be observed.

If the product can no longer be operated safely:

1. Remove the product from operation and mark it accordingly.
- ✓ It is then not permitted to continue using or operating the product.

### 5.2 Assembly information

The product must only be installed in the complete system with standard and compliant connection components (screw fittings, hoses, pipes, fixtures etc.).

The product must be shut down correctly prior to disassembly (in particular in combination with hydraulic accumulators).



#### **DANGER**

**Risk to life caused by sudden movement of the hydraulic drives when dismantled incorrectly!**

Risk of serious injury or death.

- Depressurise the hydraulic system.
- Perform safety measures in preparation for maintenance.

#### 5.2.1 Attachment

The valve bank must be mounted to the frame or base of the machine in such a way that no stress is induced. Three screws and elastic washers between the bank and the frame are recommended for mounting.

Round bearing A 2510 55WR (M8x20), manufacturer ® Co. FREUDENBERG Germany, item no. 509067

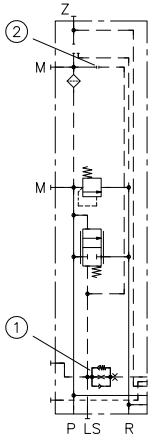
#### 5.2.2 Piping

All fittings used must utilise deformable seals. The recommended torque values must not be exceeded.

### 5.2.3 Converting the connection block from PSL to PSV

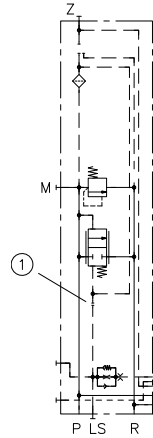
The connection block type PSL 3../D...-2 or PSL UNF 2../D...-2 can be converted at any time to a connection block for control pump systems (correct type then type PSV 3 S../D...-2 or PSV UNF 3 S../D...-2). To do so, change or swap the parts listed below.

#### PSL .../D...-2



- 1 Dampening screw 7778 301
- 2 Screw 7997 019

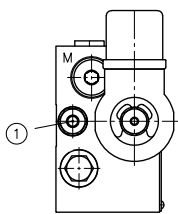
#### PSV ...S/D...-2



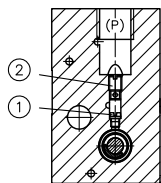
- 1 Screw 7997 019

**NOTE**

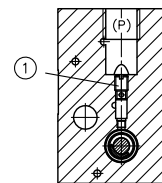
The screws, grub screw or orifice are stuck in with threadlocker fluid. During the conversion process, secure the parts against coming loose again. If type PSV is to be converted to type PSL, the existing tapped plug must also be exchanged for dampening screw S (7778 301) (not applicable for types PSV 3 S../..-2 or PSV UNF 3 S../..-2, as there is already one there).



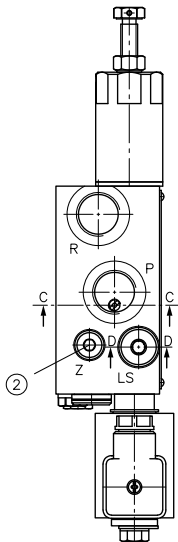
#### Cut C - C



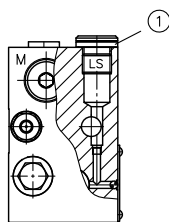
- 1 Filter screw 7700 794
- 2 Screw 7997 019



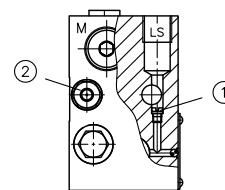
- 1 Filter screw 7700 794



#### Cut D - D



- 1 Tapped plug G 1/4 A NBR



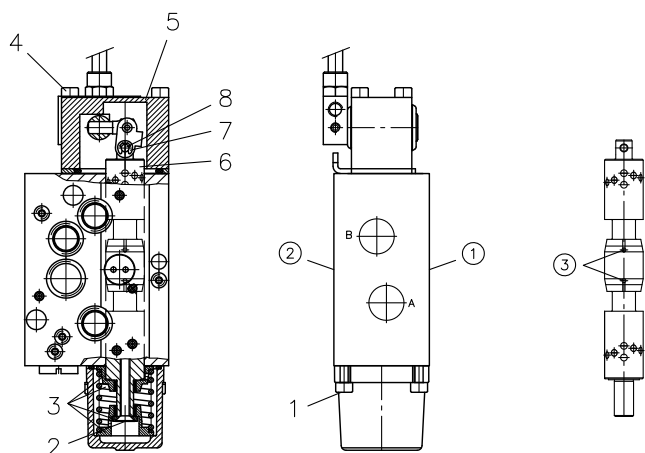
- 1 Screw 7997 019
- 2 Dampening screw 7778 301

- 1 Dampening screw 7778 301
- 2 Tapped plug G 1/8 A NBR

## 5.2.4 Notes on spool valve exchange

The valve spools are not specially adapted to a spool block. This means that spool valves can be exchanged at any time to bring them in line with any changes in consumer requirements.

**In doing so, the following must be observed:**



- 1 End plate side
- 2 Connection block side
- 3 Metering ports

### Notes on exchanging the valve spool

- 1 Unscrew screws **1** (ISO 4762-M4x12-8.8-A2-70), take off spring housing
- 2 Unscrew screw **2** M4x30
- 3 Take off spring package with spring plates **3**
- 4 Unscrew screws **4** (ISO 4762-M4x35-8.8-A2-70)
- 5 Pull the lever housing out of the spool block together with the valve spool **5, 6**
- 6 Remove retaining washer DIN 6799-2.3 and bolt **7, 8**
- 7 Proceed in reverse order to reassemble with (new) valve spool

#### ! NOTE

When assembled, the valve spool's metering ports must always face towards the end plate!

**Exception:** Valve spools with coding 40 do not have metering ports and can be installed any way around.

## 5.2.5 Seal kits

Connection block: DS 7700-21

Valve section: DS 7700-22

## 5.3 Operating instructions

### Note product configuration and pressure / flow rate

The statements and technical parameters in this documentation must be strictly observed.  
The instructions for the complete technical system must also always be followed.

#### **i** NOTE

- Read the documentation carefully before usage.
- The documentation must be accessible to the operating and maintenance staff at all times.
- Keep documentation up to date after every addition or update.

#### **⚠** CAUTION

##### **Risk of injury on overloading components due to incorrect pressure settings!**

Risk of minor injury.

- Pay attention to the maximum operating pressure of the pump and the valves.
- Always monitor the pressure gauge when setting and changing the pressure.

### Purity and filtering of the hydraulic fluid

Fine contamination can significantly impair the function of the hydraulic component. Contamination can cause irreparable damage.

#### Examples of fine contamination include:

- Metal chips
- Rubber particles from hoses and seals
- Dirt due to assembly and maintenance
- Mechanical debris
- Chemical ageing of the hydraulic fluid

#### **i** NOTE

New hydraulic fluid from the manufacturer does not necessarily have the required level of purity.  
The hydraulic fluid must be filtered during filling.

Pay attention to the cleanliness level of the hydraulic fluid to maintain faultless operation.  
(Also see cleanliness level in [Chapter 3, "Parameters"](#)).

Additionally applicable document: [D 5488/1](#) Oil recommendations

## 5.4 Maintenance information

Conduct a visual inspection at regular intervals, but at least once per year, to check if the hydraulic connections are damaged. If external leakages are found, shut down and repair the system.

Clean the device surface of dust deposits and dirt at regular intervals, but at least once per year.

## Further information

### Additional versions

- Proportional directional spool valves types PSL/PSV/PSM, size 3: D 7700-3
- Proportional directional spool valve, type PSL, PSM and PSV size 5: D 7700-5
- Proportional directional spool valve type PSLF, PSVF and SLF: D 7700-F
- Proportional directional spool valve banks type PSLF and PSVF size 7: D 7700-7F
- Actuation for proportional directional spool valves type PSL/PSV: D 7700 CAN
- Proportional directional spool valve type EDL: D 8086
- Directional spool valve banks type CWS: D 7951 CWS